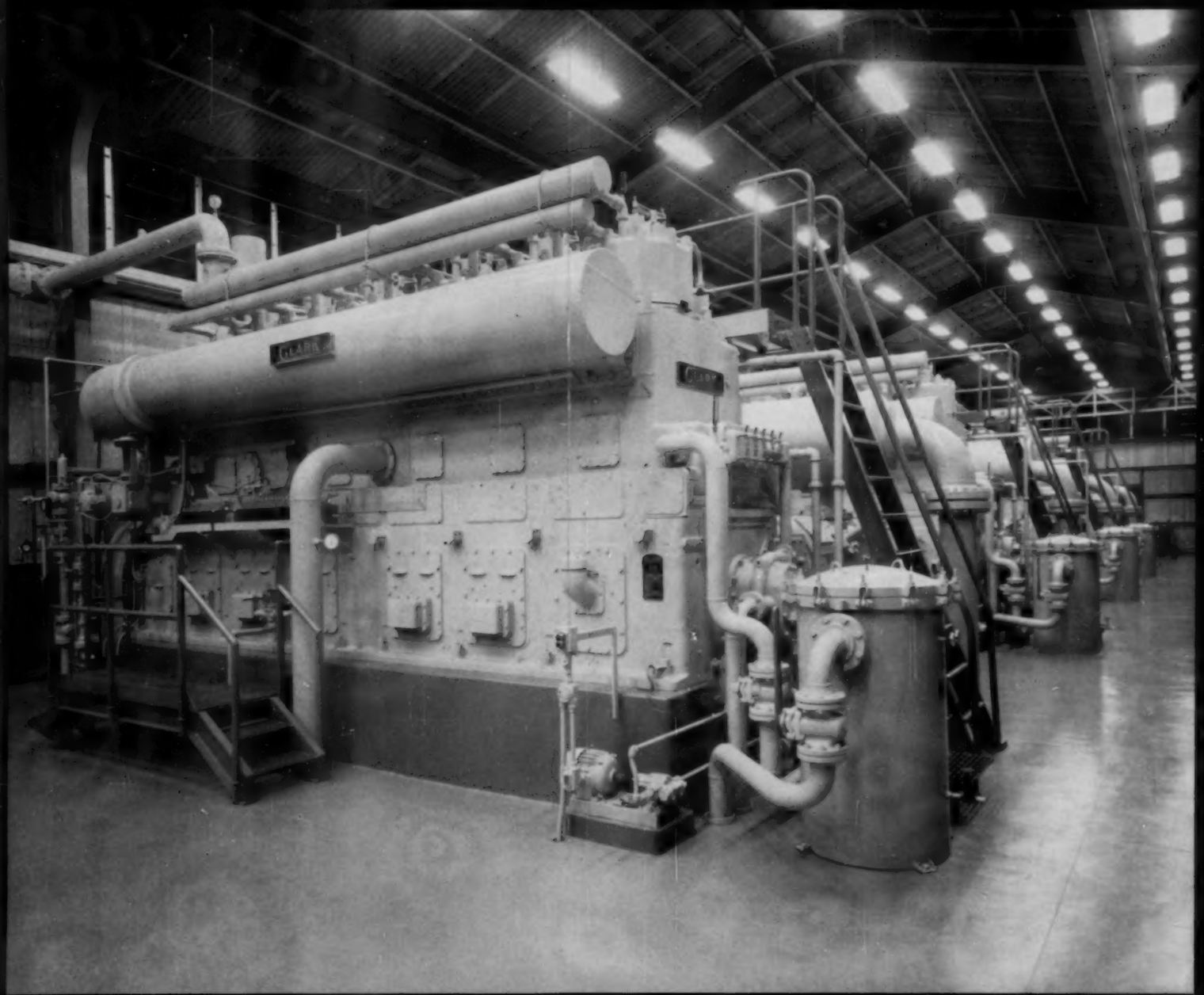
DIESEL PROGRESS

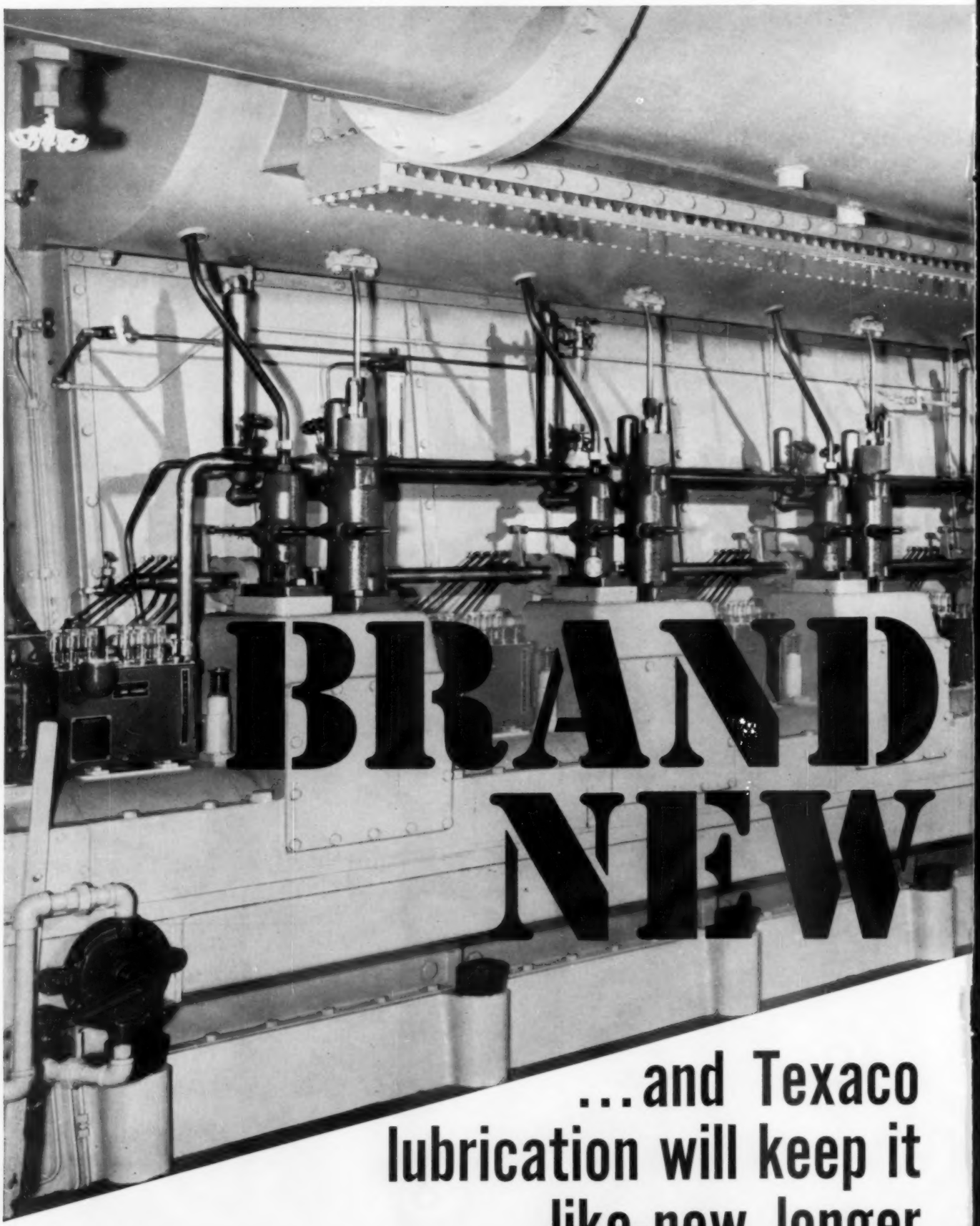
IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



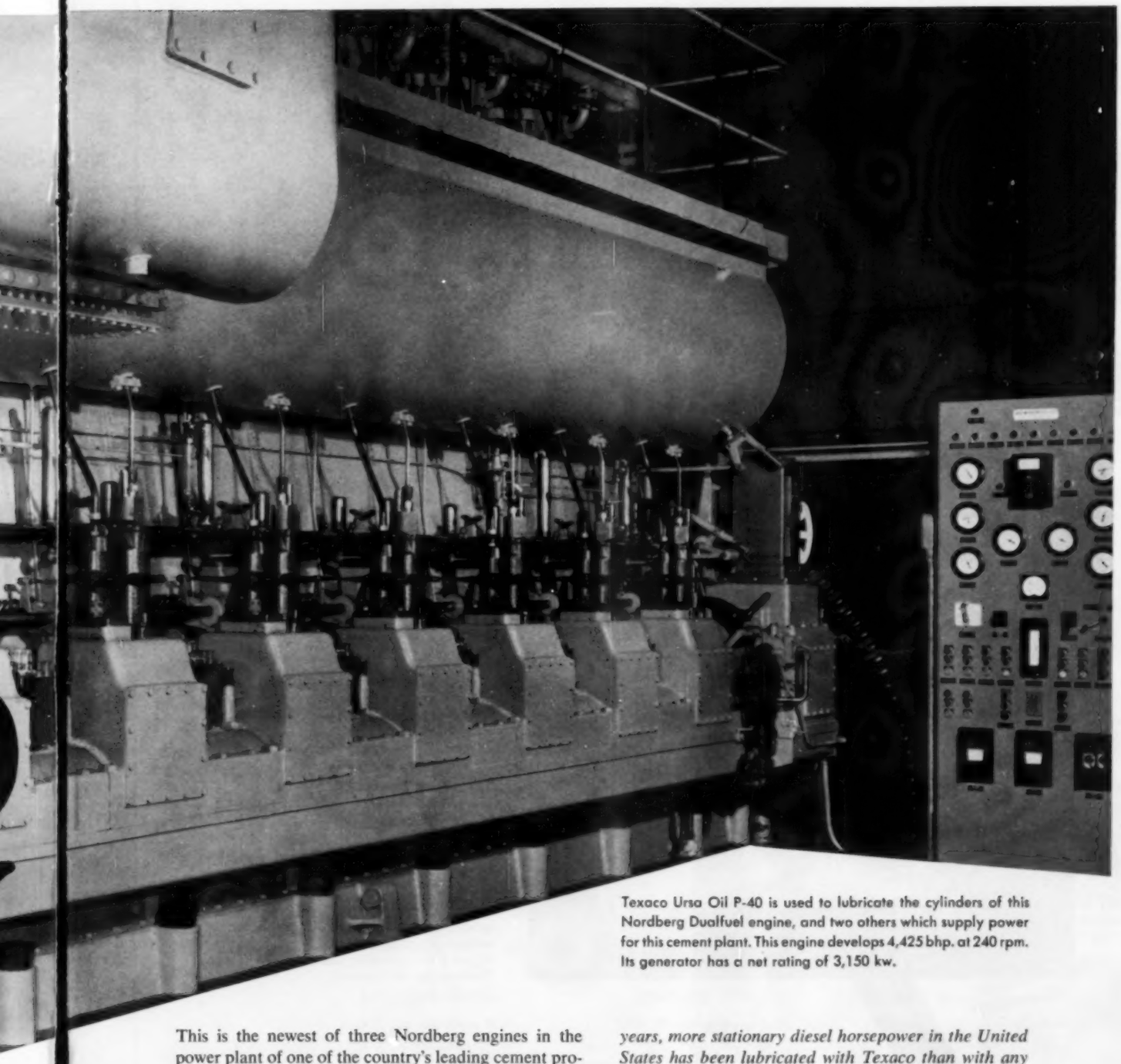
FIVE DOLLARS PER YEAR

SEPTEMBER, 1958

FIFTY CENTS PER COPY



...and Texaco
lubrication will keep it
like-new longer



Texaco Ursa Oil P-40 is used to lubricate the cylinders of this Nordberg Dualfuel engine, and two others which supply power for this cement plant. This engine develops 4,425 bhp. at 240 rpm. Its generator has a net rating of 3,150 kw.

This is the newest of three Nordberg engines in the power plant of one of the country's leading cement producers (name on request). All three engines use Texaco Ursa Oil, so the like-new qualities—low maintenance, full power, high fuel economy—will last longer.

Texaco Ursa Oil assures full compression and complete combustion by keeping the rings free. By resisting oxidation, it minimizes sludge formation and keeps the engine free of harmful deposits.

There is a complete line of Texaco Ursa Oils, refined and processed especially for the lubrication of diesel, gas and dual-fuel engines. That's why, *for over twenty years, more stationary diesel horsepower in the United States has been lubricated with Texaco than with any other brand.*

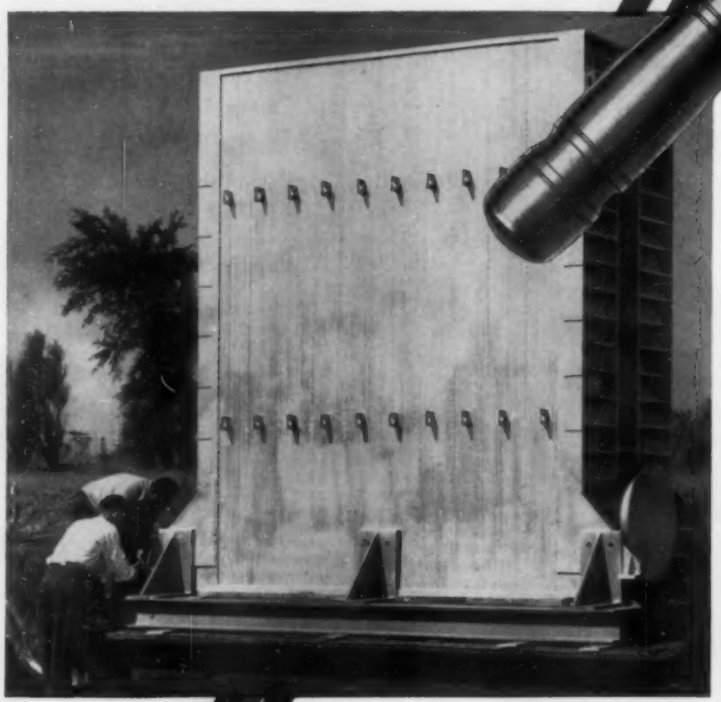
Your Texaco Lubrication Engineer offers his years of experience to help you select the right Texaco lubricant for your needs. You can contact him by calling the nearest of the more than 2,000 Texaco Distributing Plants, or by writing:

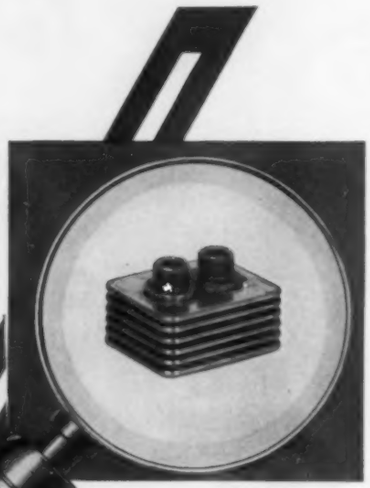
☆ ☆ ☆

The Texas Company,
135 East 42nd Street,
New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL
(parts, inventory, production, downtime, maintenance)

HARRISON SIZES UP THE JOB...





↑
2½ lb. diesel engine heat exchanger

← 58 ton gas turbine regenerator

Meet the large and small of it!
At left is a half section of Harrison's new regenerator for a General Electric combustion gas turbine. The regenerator is used by GE to boost performance and economy on the nation's natural gas lines. The entire unit is approximately 12½ feet high, 10 feet wide and 10 feet deep.

The small but vital marine heat exchanger (above) cools the oil in engine gear boxes. It is less than three inches high, four inches wide and slightly more than three inches deep.

You'll find Harrison heat exchangers on all types of diesel equipment—automotive, marine and industrial. If you have a cooling problem, Harrison has the answer!

TEMPERATURES MADE TO ORDER

HARRISON

FROM THE PROGRESS OF THE PAST... GM ...THE PROMISE OF THE FUTURE

HARRISON RADIATOR DIVISION • GENERAL MOTORS CORPORATION • LOCKPORT, NEW YORK

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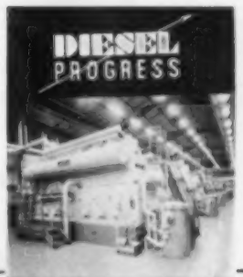
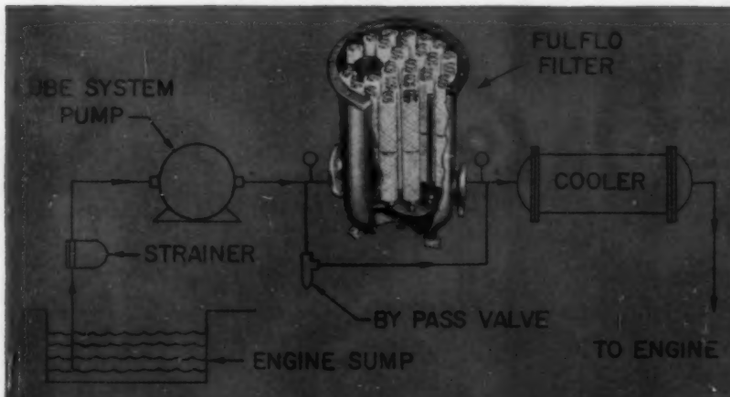


FRONT COVER ILLUSTRATION

Four Clark 2000 hp. engine compressors installed at Needles, California Pipeline Station pumping natural gas from the Four Corners to Los Angeles.

Get longer engine life—

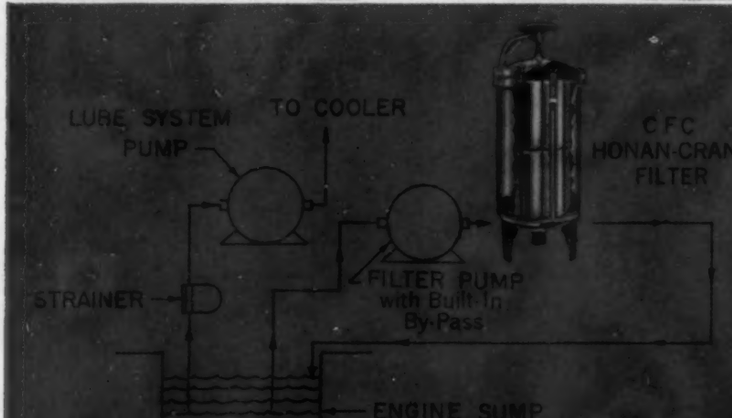
with Fulflo and CFC Honan-Crane Lube Filtration Systems



FULL FLOW SYSTEM

For True Depth Filtration: Fulflo Filters with genuine Honeycomb Filter Tubes (illustrated) provide micro-clarity of lubricating oils for stationary engines, mobile equipment and for bulk filtration.

For Surface Full Flow Filtration: CFC Flo-Pac is offered in a variety of models using 1 to 36 resin-impregnated pleated paper cartridges.



BY-PASS SYSTEM

The CFC Honan-Crane Multi-Cartridge Filter (illustrated) offers seven types of interchangeable cartridges — inert media for solid contaminants, or Cranite (fuller's earth) for removal of solid particles and all products of oxidation.

CFC Michiana Filters, furnished as original equipment for many leading diesel engine builders, are available in a variety of models to provide rugged, efficient service, within a minimum space requirement.

Fulflo Filters for diesel *fuel* may be applied to either pressure or suction side of fuel line.

For new catalog, write today to Department DS

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo Filters — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC Filters — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

One set of spare parts serves all these 18 HERCULES engines

Here's parts interchangeability to warm a maintenance man's heart! Hercules designed the new DD diesel and GO gasoline engines with the user in mind: succeeded in achieving a unique degree of interchangeability that reduces spare parts requirements for Hercules-powered equipment to a minimum.

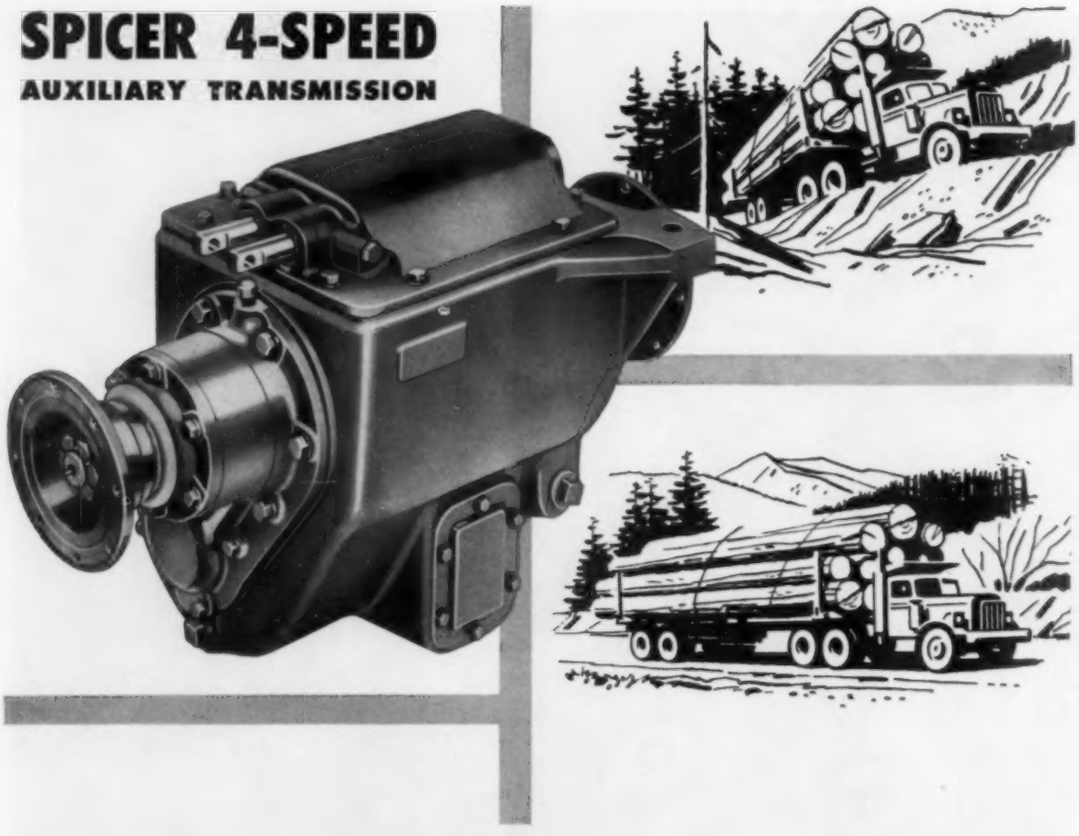
Actually, the illustration above doesn't tell the whole story. To do that, we'd have to show 6 power units as well as all 18 models of 3, 4, and 6-cylinder engines available in the DD and GO series—a total of 24 power plants using many of the same wearing parts!

You can take advantage of this maintenance economy by specifying Hercules diesel, gasoline, or LP-gas power for the equipment you buy. If you'd like the full story on these modern engines, write Hercules Motors Corp., Canton 2, Ohio—or call your Hercules distributor: there's one in the Hercules worldwide network near you.

HERCULES

HERCULES MOTORS CORPORATION
Canton, Ohio

SPICER 4-SPEED
AUXILIARY TRANSMISSION



A deep underdrive *plus* a splitter for a faster pull up any grade

Now . . . with the Spicer 4-speed auxiliary transmission . . . you can equip your vehicles with the right ratio for every grade, whether on or off the highway.

In the same dual-purpose gearbox, there's a deep underdrive — for added pulling power — and a splitter ratio that speeds up the long pull. As a further advantage, the use of the splitter gear avoids engine lugging under almost any condition and makes it easier to keep engine RPM in the most efficient range for greater fuel economy.

For convenience in gearing up, the Spicer 4-speed auxiliary is directly interchangeable with present 3-speed auxiliary transmissions. Companion flanges, drive shaft length and shift lever controls can all remain the same.

As an added option, the 4-speed transmission is offered with a top-mounted power take-off capable of transmitting full engine torque. Or, where lightweight design is desired, you can order the Spicer 4-speed transmission with an aluminum case . . . saving 80 lbs. of weight.

For further specifications, write the Dana Corporation, Toledo 1, Ohio, and mention the vehicle you're planning to gear up.

DANA Spicer

DANA CORPORATION • Toledo 1, Ohio

DANA PRODUCTS Serve Many Fields:

AUTOMOTIVE: Transmissions, Universal Joints, Propeller Shafts, Axles, Powr-Lok Differentials, Torque Converters, Gear Boxes, Power Take-Offs, Power Take-Off Joints, Clutches, Frames, Forgings, Stampings.

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MARINE: Universal Joints, Propeller Shafts, Gear Boxes, Forgings, Stampings.

Many of these products manufactured in Canada by Hayes Steel Products Ltd., Merritton, Ont.

DIESEL FUEL and LUBRICATION

BULLETIN

CITIES SERVICE

The Bradford Weston Story:

16,000 HOURS WITHOUT OVERHAUL!

Bradford Weston Inc., of Hingham, Massachusetts is getting the kind of diesel performance many a maintenance man dreams of.

Since 1947, their diesel quarry shovel has operated more than 16,000 hours without overhaul, using Cities Service Diesel Engine Oil!

Two factors enabled this performance. First, due to extremely dusty conditions, Bradford Weston made oil changes every 150 hours and changed filter every 500 hours. Second, the extremely effective additive formulation in Cities Service C-300 Diesel Engine Oil held sludge, carbon and varnish to the barest minimum.

Examples of truly outstanding performance such as this are not unusual where Cities Service Lubricants and the Cities Service Lubrication Engineer have been at work. If you're not getting all the hours of work you think *your* equipment should give, call in the man from Cities Service. He'll gladly make a free lubrication survey. Contact the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

MAN YOU SHOULD KNOW

Lubrication Engineer James Robertson of the Cities Service office in Chicago typifies the experienced specialists who can help you solve your lubrication problems. Wherever your plant is located—anywhere east of the Rockies—there's a nearby Cities Service office and Lubrication Engineer to serve you. For the address of the nearest office, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

225,000 Miles—Needs No Overhaul!

Another exceptional performance record has been set by this diesel-driven rock truck at Bradford Weston. Since 1952, it has provided constant heavy-duty service without overhaul, using Cities Service C-100 Diesel Engine Oil. Heavily fortified and highly detergent, Cities Service C-100 Oil is often used where maximum load or overload and high engine temperatures prevail. It is also excellent for intermittent-load, low temperature operation.

P&H DIESELS

fastest growing name in Diesel power

FOR CONSTRUCTION EQUIPMENT. Throughout the construction industry, equipment powered with this prime mover is setting new standards for production and maintenance economy. Front end loaders, excavators, truck cranes, graders, compressors, crushers and hoists all perform better—encounter less stalling in handling momentary overloads and during the course of idling—experience less downtime for service and repairs.

FOR BOATS. P&H Diesels for marine propulsion and auxiliary power in work, crew, fishing and pleasure boats offer a new concept of dependable horsepower in the smallest amount of space below deck—and with the least weight. P&H simplicity of design meets the vital need at sea for maximum safety while permitting travel with a minimum parts inventory.

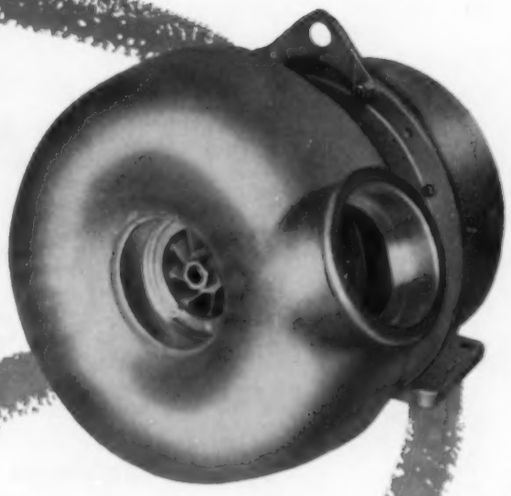
FOR TRUCKS AND BUSES. P&H Diesels of modern aluminum design offer weight savings up to 1,000 lbs.—a distinct income-producing feature when translated in terms of increased payloads and extra revenues. High torque and lots of reserve power also result in greater lugging ability and in minimum shifting on grades—faster trips for P&H Diesel powered trucks and buses.

HARNISCHFEGER

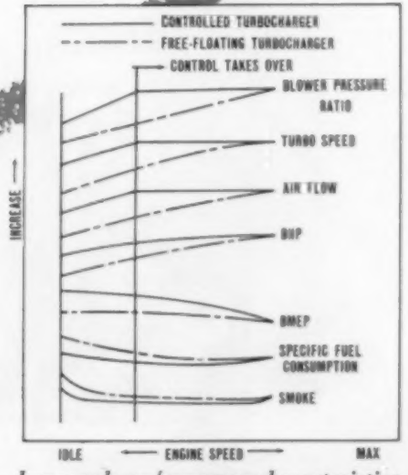
P&H Diesel Engine Division • Crystal Lake, Illinois

- ***INDUSTRIAL • AUTOMOTIVE • MARINE***
  2, 3, 4 and 6 Cyl. Models from 40 to 280 HP
- ***GENERATOR SETS***
  20 to 125 KW, AC or DC

NOW!
CONTINUOUS, FULL POWER TURBOCHARGING



AiResearch control system keeps turbocharger output at ideal level



Improved performance characteristics of a typical turbocharged diesel engine equipped with the new AiResearch Turbocharger Control System.

Accurate control of turbocharger speed over its complete range regardless of changing load characteristics has been achieved with the new AiResearch Turbocharger Control System. This automatic control system delivers more air to the engine when needed and greatly increases torque rise, giving turbocharged diesel engines greater lugging ability when operating under heavy loads. By contrast, free-floating turbochargers operate at reduced RPM when the engine is working at below-maximum engine speed.

This improved air delivery system greatly increases the acceleration, for example, of turbocharged diesel trucks up steep grades. In a typical case, the round-trip time of a trucking company operating between Phoenix and Denver was cut from 48 hours to 42 hours. Over short hauls an off-the-road truck cut its 27-minute round-trip time to 18 minutes. Comparable gains are made for all types of turbocharged diesel equipment, stationary or mobile.

The two components of the new control system are a pressure ratio sensor and an exhaust by-pass valve. They control the speed of exhaust-driven turbochargers by modulating the amount of engine exhaust used. This eliminates overspeeding of the turboblower, and at the same time provides higher turboblower speed while lugging. Smoking is virtually eliminated under all conditions.

Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

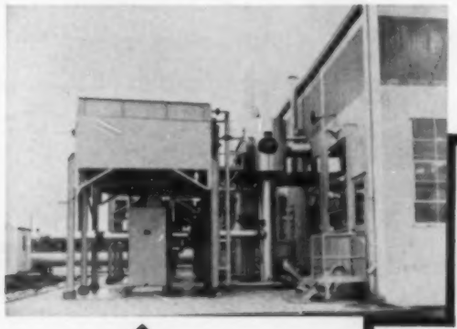
UNITED GAS PIPE LINE CO. INSTALLS VAPOR PHASE®

to cool 3 compressor units with own waste heat

System Increases Engine Output and Life; Reduces Cylinder Wear; Would Permit Use of Sour Gas Fuel

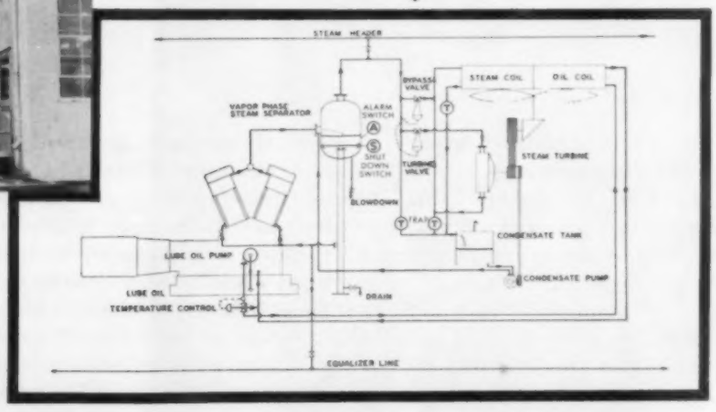
The 3-880 H. P. Gas Compressors at UGPL's Cabeza Creek station, near San Antonio, Tex., installed in 1957, are taking the power to drive their cooling fans from the waste heat of their own operation. The formerly wasted heat is taken from the VAPOR PHASE® separators in the form of low pressure steam. This steam drives the cooling air fans through steam turbines, an exclusive patented feature of the Vapor Phase System.

The decision to install Vapor Phase® Thermal Circulation Cooling was based on the successful operation of a similar installation, made in 1953, on 5-880 H. P. engines at UGPL's Agua Dulce Station which resulted in better combustion, reduced cylinder and ring wear and lowered operating costs.



CABEZA CREEK STATION — Steam generated from waste heat passes through Vapor Phase® Steam Separator and operates turbine driven fan, condensing the steam and cooling the lube oil. Operating costs are reduced while freeing the engines for greater power output.

VAPOR PHASE® FLOW DIAGRAM — water and steam from the engine power cylinders flow through a header to the Vapor Phase® steam separator. Steam produced powers the turbine driven fan which furnishes air to dissipate engine heat. All condensate is returned to the water and steam header. Water from the separator circulates through the power cylinder jackets by gravity.



"Sole Developers and Manufacturers of Vapor Phase® Thermal Circulation (Ebullition) Engine Cooling"

ENGINEERING CONTROLS, Inc.

AN AFFILIATE OF ST. LOUIS SHIPBUILDING & STEEL CO.

611 East Marceau Street
St. Louis 11, Missouri

1939 North Hillhurst Avenue
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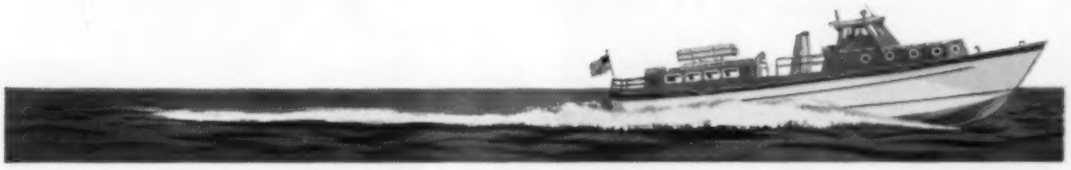
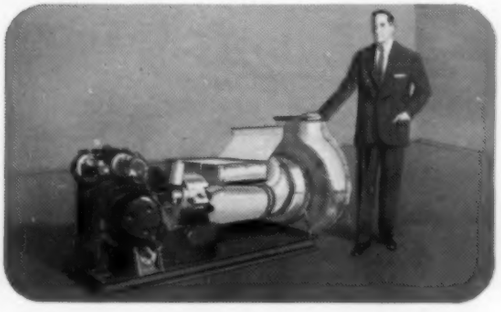
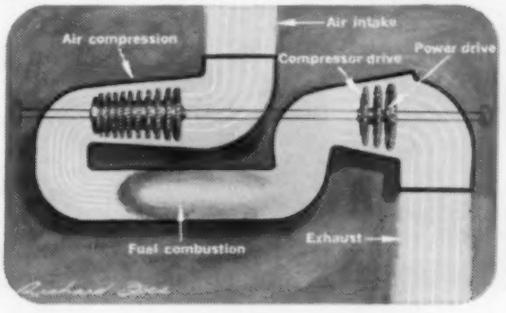
Remarkable Advantages of Solar Marine Gas Turbine Engines!



❶ Instant acceleration! Greater Speed!

Fast, dependable Solar turbines are setting new standards of performance and reliability in marine propulsion. One of the most powerful engines for its size in the world, Solar's 500 horsepower Jupiter® reaches full propeller rpm from cold start in a matter of seconds, accepts maximum load without laboring or harm to engine. And boats powered by husky Jupiter turbines show vastly increased speeds over comparable boats with conventional engines.





❷ Extremely lightweight

The basic Jupiter engine weighs about 700 pounds, or less than 1/6 the weight of marine diesels of similar horsepower! This weight saving means lighter boats.

❸ Small size—low silhouette

Solar's Jupiter engine occupies 71 cubic feet, a diesel of similar horsepower 233 cubic feet. The engine's low silhouette gives greater design flexibility.

❹ Uses any fuel

Solar turbines operate efficiently on almost any type of fuel, including low-cost diesel fuels. This fuel versatility greatly minimizes cost and supply problems.

❺ Completely vibration free

Because gas turbines are of rotating rather than reciprocating design, there is no laboring under full load. Sound level is low, even during fast acceleration.

❻ Simple design—few moving parts for low maintenance

Gas turbines are the simplest of all heat engines. Overhauls are infrequent and routine servicing can be completed in a few hours. Parts are easily interchanged and are available for off-the-shelf delivery.

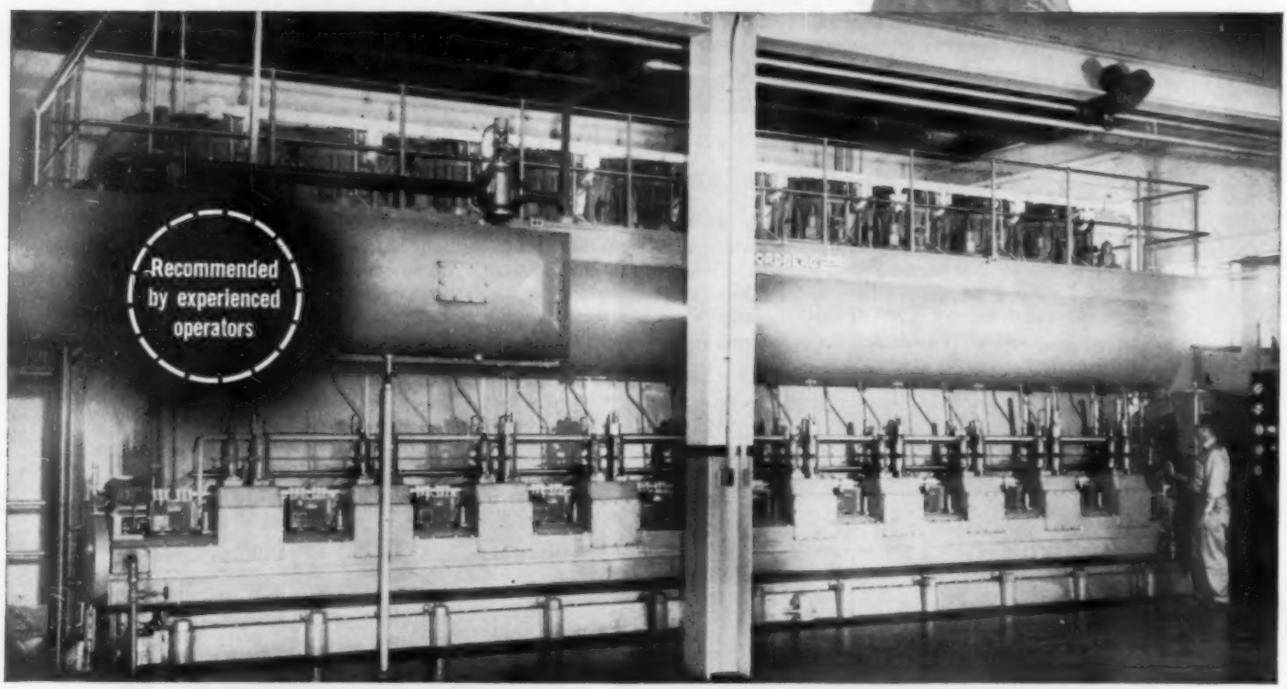
New, high-performance commercial boats, utilizing both direct drive and V-drive Jupiter engines, are in work now. For full details about these remarkable new power plants, write to Dept. F-66, Solar Aircraft Company. We'll include a free gas turbine brochure.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO
DES MOINES

2200 PACIFIC HIGHWAY, SAN DIEGO 12, CALIFORNIA

"With records like these . . . Sidney is well pleased with its NORDBERG ENGINES"

• • • says Mr. Armour Boese, Superintendent
Municipal Power Plant, City of Sidney, Nebraska



Mr. Boese writes: "Our 8-cylinder Nordberg Duafuel engine installed in November 1952 now has over 34,000 hours of operation and until our new 10-cylinder unit was installed recently the engine had operated about 83% of the possible time with very little maintenance attention. Recently we checked the liner wear in one of the cylinders and found a maximum wear of .0065". Our bearings have never been replaced and many of the piston rings are still in service. We are still averaging over 9,000 BHP-hours per gallon of lube oil.

The fuel cost of the 8-cylinder unit has averaged 2.91 mills per KWH, based upon 25¢ per million BTU gas and 10¢ per gallon pilot oil. Our average load has been about 74%.

As a matter of comparison our new 10-cylinder Duafuel engine averaged a fuel cost of 2.41 mills per KWH during full load acceptance tests. During these tests we actually handled as much as 30% overload with the engine on gas."

Records like these are the reason why so many orders for Nordberg Diesel, Duafuel® and Spark-Ignition Gas engines are repeat orders. Next time you need long term, dependable power, consult Nordberg . . . builders of America's largest line of heavy duty engines.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

. . . . . .

Installation Data:

1952—Installed 3060 bhp Nordberg Duafuel engine—2160 KW

1956—Installed 4380 bhp Nordberg Duafuel engine—3125 KW

(Ratings at plant altitude of 4100 ft.)

NORDBERG

© 1958, Nordberg Mfg. Co.

P458

SYMONS® CRUSHERS and SCREENS

MINE HOISTS

RAILWAY TRACK EQUIPMENT

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6 REASONS WHY IT PAYS TO STANDARDIZE ON ROBERT BOSCH INJECTION NOZZLES

® Reg. U. S. Pat. Off. ROBERT BOSCH GMBH Stuttgart

1: Leadership: ROBERT BOSCH Fuel Injection Equipment made the high-speed diesel engine practicable.

2: Consistent quality: Unmatched record of performance on literally millions of engines.

3: Widest selection: ROBERT BOSCH offers the most complete line of nozzles available.

4: Service everywhere: Not only nation-wide, but world-wide.

5: Standard equipment: Leading gasoline and diesel engine manufacturers here and abroad use ROBERT BOSCH equipment for their most advanced designs.

6: Higher quality at lower price: Sets new standards of long-life efficiency—yet actually is priced lower.

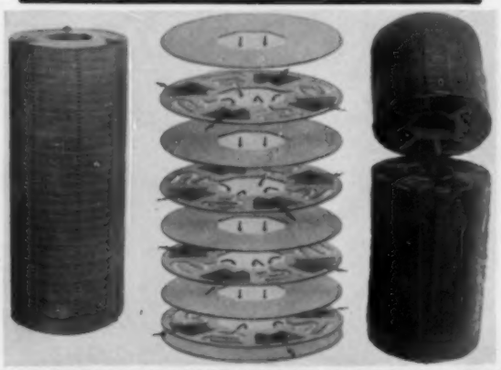
ROBERT BOSCH CORPORATION

Long Island City, N.Y. San Francisco, Calif.

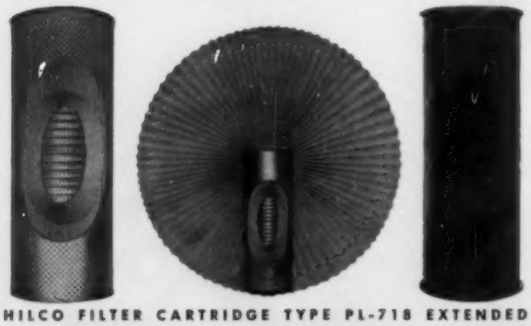
New HILCO® FULL FLOW FILTERS

with these features:

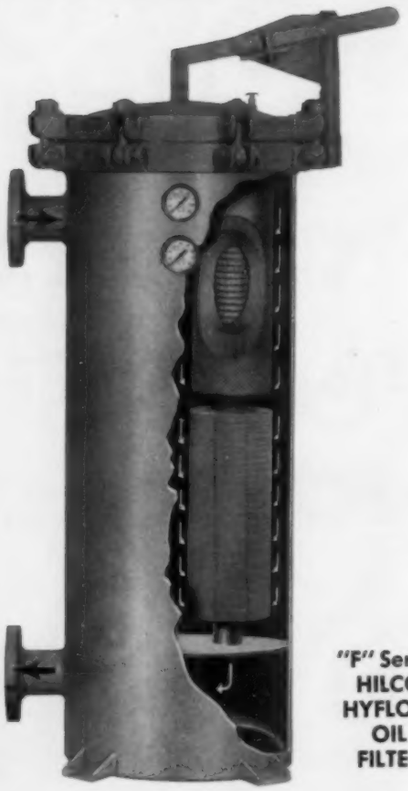
- ✓ High flow rates
- ✓ Low pressure drop
- ✓ Choice of filter cartridges
- ✓ Large dirt storage area
- ✓ All steel welded construction
- ✓ In-out pressure gauges
- ✓ Quick action cover lifter
- ✓ 100 psi standard design pressure
  Higher pressures upon specification
- ✓ Swing bolt cover construction



HILCO FILTER CARTRIDGE TYPE FW-718 COMBINATION EXTENDED SURFACE AND DEPTH MICRO FILTRATION



HILCO FILTER CARTRIDGE TYPE PL-718 EXTENDED SURFACE FOR EXTREMELY HIGH FLOW RATES



"F" Series HILCO HYFLOW OIL FILTER

HILCO Full Flow Filters Available in Capacities Up to 2000 GPM and Micro Filtration at That . . . Removing Particles 5 Microns and Smaller

● Write to the PIONEERS of Micro Full-Flow FILTRATION

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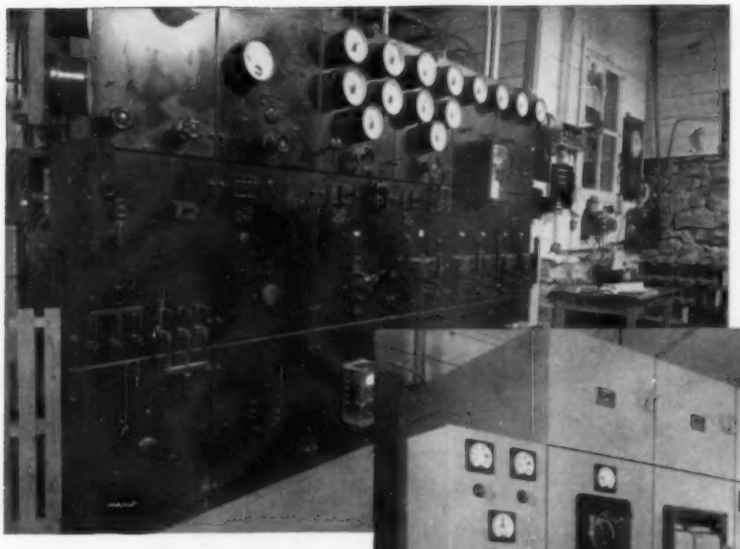


◀ Old

Old switchgear at Big Falls, Minnesota hydroplant of Border Counties Power Cooperative, Inc. System expansions had caused this board to become dangerous by today's standards, capacity insufficient, and increasingly tedious to handle.

New ▶

Custom-designed by E-M from standard components, this new switchgear at Big Falls gives extra safety and convenience. All apparatus is completely enclosed, yet readily accessible because of E-M's specially designed Swing-Door Instrument Panels. Operation, inspection, and testing is safe, convenient, and simple.

Making switchgear meet power system expansions

● Power systems grow larger . . . and larger . . . and larger. Electrical apparatus of all types must keep pace with this rapid expansion. The plant switchgear, with its vital safety and control functions, must be closely matched to increased demands made upon it.

At Border Counties Power Cooperative, Inc., size of the system *tripled*. Having had previous experience with E-M's personalized engineering assistance and with the safety and service of E-M designed apparatus, they called on E-M engineers to work out the new switchgear with consulting engineers R. D. Thomas and Associates.

Equipment necessary to handle the greatly increased system had to be fitted deftly into available space. This made E-M's Swing-Door Instrument Panel a natural choice, as this panel makes use of every available inch of space, both on door and interior of cabinet. Mounted on hinges, the Swing-Door Panel opens as a door to reveal a compact, easy-to-reach arrangement of components, all accessible without reaching across buses or terminals. The E-M Switchgear is designed for tomorrow's increased loads as well, with breakers of adequate interrupting capacity.

"Personalizing" of E-M Switchgear, as was done at Big Falls, means that each E-M board is *matched exactly* to what it will encounter in daily service. This complete, attentive, and highly specialized E-M engineering can be of service to you. Call your nearest E-M sales engineer for more facts, and be sure to write the factory for E-M Switchgear Publication No. 194.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

Specialists in **MODERN SWITCHGEAR DESIGN**

E-M

4200-TPA-2163

THIS MUCH DIRT CAN RUIN A DIESEL ENGINE

THIS PUROLATOR FILTER

STOPPED THIS MUCH DIRT

Diesels can't escape abrasive dirt . . . and it takes about 8 ounces of it to ruin an engine.

The 18 pounds of dirt shown above were stopped by a Purolator heavy duty dry type air filter on a rock drilling rig in 940 hours of operation—with no servicing of the filter required. The 6 cylinder, 2 cycle engine and the 750 CFM compressor used on the job were fully protected through the toughest operating conditions. 18 pounds of dirt were stopped . . . none got through the filter.

There's a Purolator dry type air filter designed to meet the specific requirements of your operation. Write today for full information. If you have a particularly tough problem, describe it . . . Purolator has the solution.

Filtration For Every Known Fluid **PUROLATOR**

PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

NEW! High-pressure supercharging at low rotor speeds with Thompson Turbocharger

Simple, straight rotor vanes enable the new-design Thompson Turbocharger to produce economical high-pressure blowing of diesel engines even at low rotor speeds. Wear on parts is reduced, maintenance and downtime are kept to a minimum.

In the development labs of the Tapco Group, impeller vane contours were developed to make use of Thompson's two decades of experience in high efficiency movement of air and gases.

Other *new* features of Thompson Turbochargers include unique small-diameter shaft and bearing to provide lower shaft surface speeds at equal compression ratios. Bearing and shaft wear is kept to a minimum. In addition, unique Thompson design keeps exhaust heat from traveling to bearings and compressor side of the Turbocharger.

If you build supercharged diesel engines up to 300 horsepower, we can supply a Thompson Turbocharger to provide even more horsepower and fuel economy. If you install diesel engines in trucks or diesel-powered equipment, you'll increase horsepower without increasing engine size by specifying Thompson Turbochargers.

Our sales engineers will help you make the switch to Thompson Turbochargers with practically no redesign of exhaust or intake side. When may they call?

TAPCO GROUP
Thompson Products, Inc.
CLEVELAND 17, OHIO

Write today on your company letterhead for Booklet DPR-958, which contains technical data on Thompson Turbochargers for blown diesel engines up to 300 horsepower.

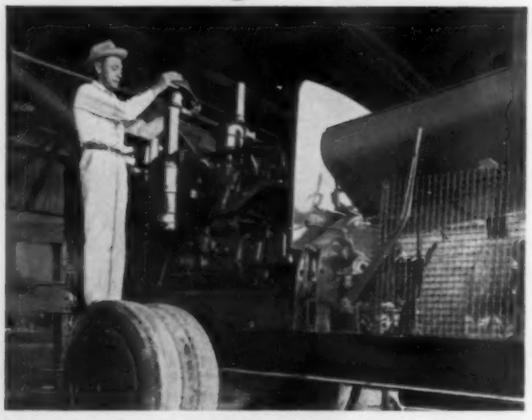
ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

FIRM M. M. SUNDT CONSTRUCTION CO. Tucson, Arizona

RPM DELO OIL ends 5 years of engine troubles

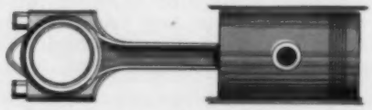
The pan has never been off the Caterpillar D7 engine of this Link-Belt Speeder shovel in 7 years, using RPM DELO Oil. Only repair was a single valve job—no other parts replaced. William Naumann, Sundt's Operations Manager, says, "We tried nine different major brands of oil in five years, trying to lick the frequent breakdowns that slowed our operations. Sometimes, main and rod bearings even froze solid on the crankshaft. We changed to RPM DELO Oil seven years ago, and, since then, have never had any engine troubles due to oil failure. We now use RPM DELO Oil exclusively in our 22 heavy-duty engines."



Lubricated with RPM DELO Oil, this Caterpillar D 13000 portable unit powered a rock crusher of M. M. Sundt Construction Co. for a total of 8976 hours before overhaul. "In spite of extremely dusty conditions the only time the engine was touched was to replace a head—no other repairs were necessary," reports master mechanic Billy Gray, shown replacing air cleaner on unit following overhaul.

Austin 101 rock crusher, powered by Caterpillar unit described above, works 20 hours a day at firm's materials stockpile outside Tucson. Company works year around on road paving, grading, foundations, building construction.

Why RPM DELO Oils reduce wear —prolong engine life



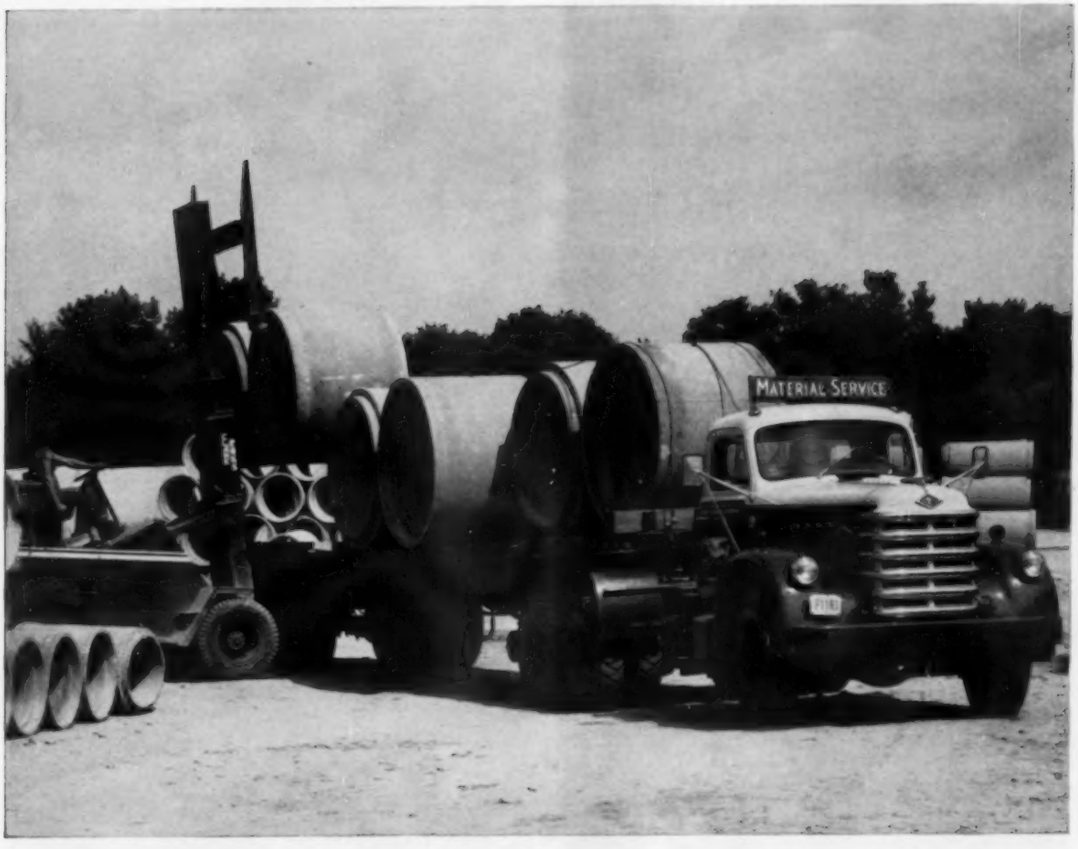
● Oil stays on engine parts—hot or cold, running or idle ● Anti-oxidant resists lacquer formation ● Detergent keeps parts clean ● Special compounds prevent corrosion of bearings ● Inhibitor resists crankcase foaming

LUBRICATING GOLD RPM DELO

For More Information or the name of your nearest distributor, write or call any of the companies listed.

TRADEMARK "RPM DELO" AND DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey
STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA COMPANY, Denver 1, Colorado



Geared by FULLER...

New Diamond T's for Material Service Corporation

Hauling heavy loads into sandy, muddy construction sites is daily routine for Material Service Corporation. This well-known Chicago area supplier of construction materials and concrete products knows what this work requires of trucks: ***heavy-duty components throughout!***

That's why Material Service specified Fuller 5-A-65 Transmissions in the recent purchase of Diamond T Model 830-32M Trucks.

Fuller Transmissions are designed for long and satisfactory service . . . for heavy loads, steep grades and the stress of constant shifting. Specify Fuller Transmissions wherever the "going's tough" . . . to deliver maximum horsepower through the *right* gear ratios . . . to speed work cycles at lowest cost! Get the facts from your truck manufacturer or truck dealer . . . or write Fuller Manufacturing Company for details.

Material Service Corporation's new Diamond T 830-32M's feature Fuller 5-A-65 Transmissions and Eaton-Hendrickson Tandems. Concrete pipe being loaded is typical of loads carried by this well-known construction material supplier.

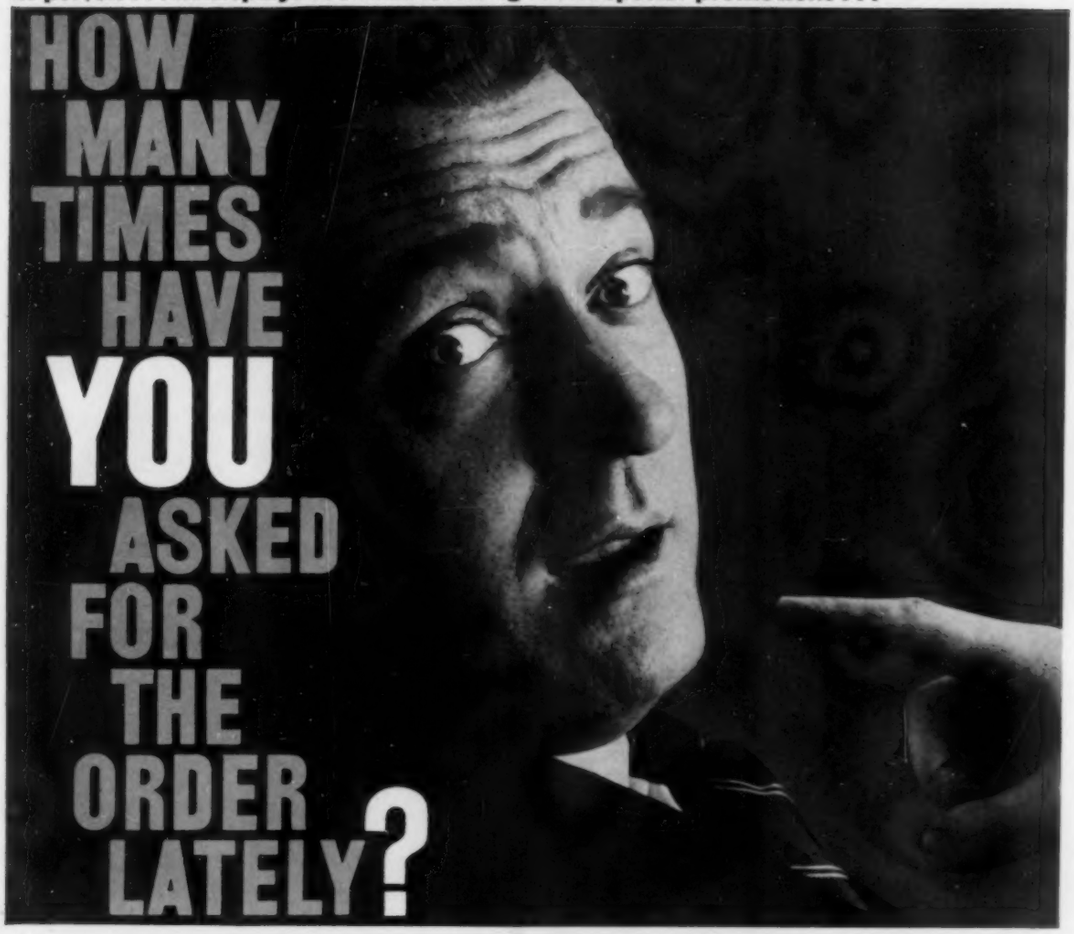
FULLER

TRANSMISSIONS

FULLER MANUFACTURING CO. Transmission Division • Kalamazoo, Mich. Subsidiary, Eaton Manufacturing Company

Unit Drop Forge Div., Milwaukee 1, Wis. • Shuler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest Dist. Office, Tulsa 3, Okla.

In person . . . in displays . . . in advertising . . . in special promotions . . .



get the goods and then go get the sale!

Let's face it—the honeymoon is over! The word "*sell*" is back!

And don't blame the times! You're living in a growing America! Between now and 1975, there will be more people . . . more jobs . . . more income . . . more production . . . more saving . . . more research . . . and more needs than ever before in our history.

The business is there! BUT . . . *you* have to go get it! It might take a little personal attention. It might take a special promotion or store display. It might mean more—and better—advertising. It certainly means *asking* for the order!

Check your stock. Bring it up-to-date! Then do the same with your selling ideas! The results will astound you!

FREE! *Get going today!* Write at once for illustrated "How To Turn the Tide" booklet offering valuable and vital selling ideas. The Advertising Council, 25 West 45th Street, New York 36, New York.

YOUR FUTURE IS GREAT IN A GROWING AMERICA

Allis-Chalmers saves you money 3 ways

DO MORE POWER

Provides maximum work per operating dollar—Allis-Chalmers engines give you real *Do-More Power* — with high torque, efficient combustion that squeezes the last bit of energy from every bit of fuel.

Keeps working day after day—There is unusual performance in rugged Allis-Chalmers engines — there is less wear, less that can go wrong.

Gets back to work faster — Design simplicity means easier servicing, too. Allis-Chalmers diesel engines are back to work quickly because you are close to fast parts and service, wherever you are.

See your Allis-Chalmers dealer for full information on engines that save you money, 9 to 516 hp, any fuel, any application. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Koehring Model 205 ½-yd shovel with Allis-Chalmers 273 engine loading copper ore at Tejano Mining Company in New Mexico. 8C-17A

To increase fatigue resistance, endurance limit and to fight the corrosive action of the sea, Erie Forge & Steel technicians cold roll ship's tail shafts as illustrated above. The life of the forged steel tail shaft is prolonged by cold rolling under the propeller and the after bearing. The surface toughness thus effected reduces fretting corrosion, minimizes pitting, costly failures and the hazard of propeller loss at sea.

Cold rolling is applied not only to new shafting but also for reconditioning existing ship's shafts, thus saving sizeable replacement costs in many instances.

Designed and built by Erie Forge & Steel engineers, the machine cold rolls shafts of any length and up to 30 inches in diameter. Any desired pressure up to 37,000 pounds can be exerted by the hardened steel rollers on each side of the shaft.

The Society of Naval Architects and Marine Engineers recommends that all ship's propeller shafts be cold rolled as a safety measure. This cold rolling process is approved by The Bureau of Ships, United States Navy.

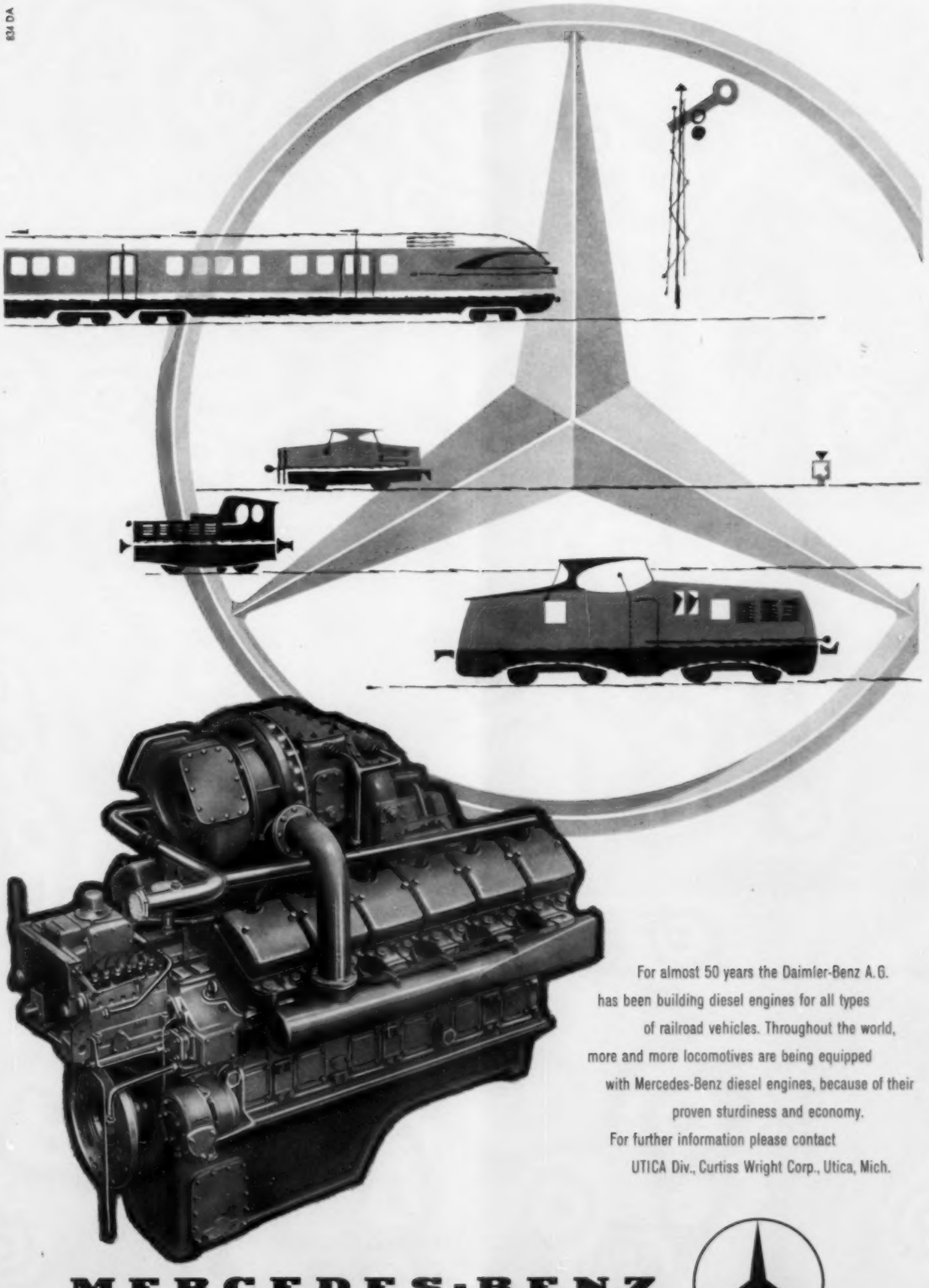
Another of the special services characteristic of the continuing progress in steel improvement at Erie Forge & Steel. Let us work with you on your steel forging and casting requirements.

ERIE FORGE & STEEL CORPORATION

ERIE, PENNSYLVANIA

MEMBER AMERICAN IRON AND STEEL INSTITUTE

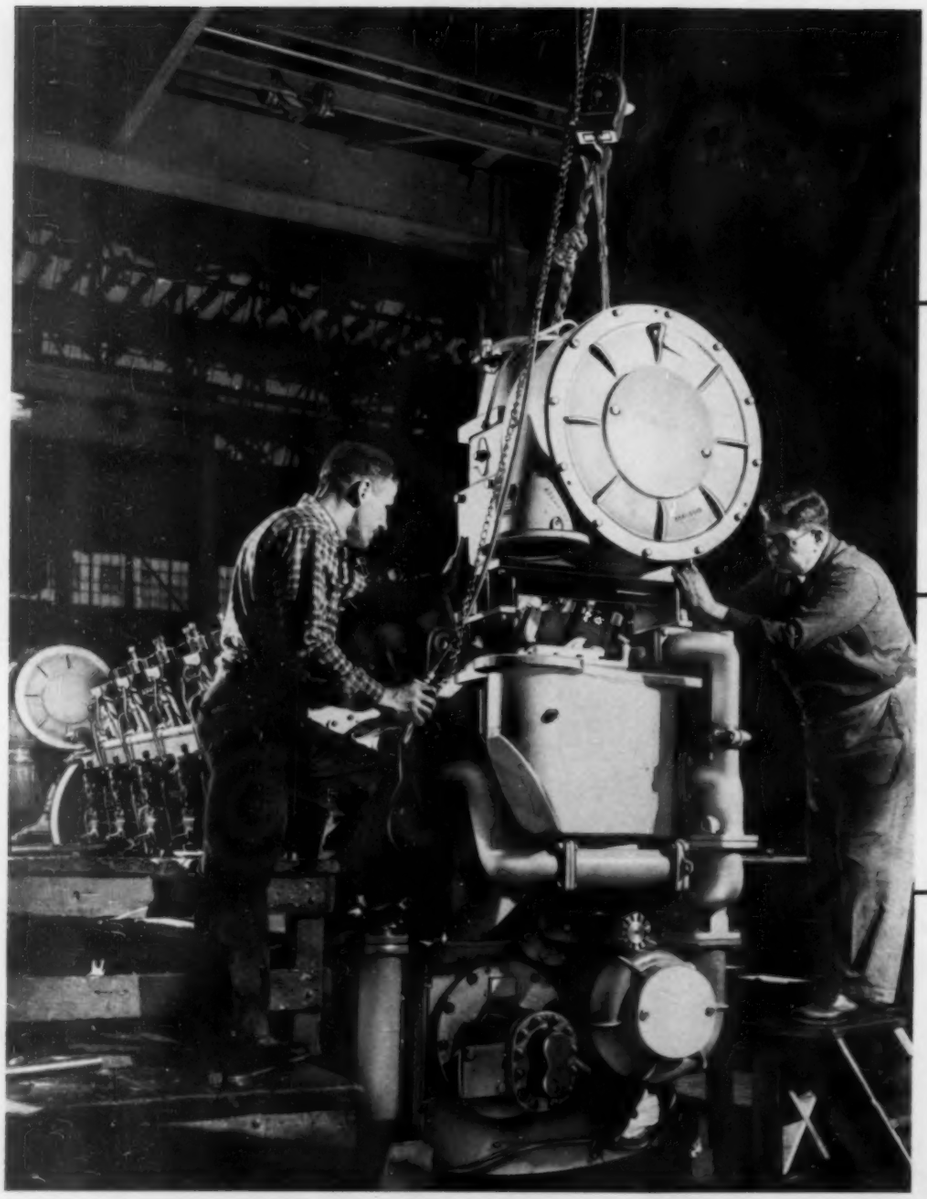
834 DA



For almost 50 years the Daimler-Benz A.G. has been building diesel engines for all types of railroad vehicles. Throughout the world, more and more locomotives are being equipped with Mercedes-Benz diesel engines, because of their proven sturdiness and economy.

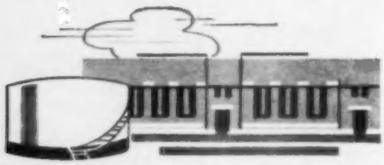
For further information please contact UTICA Div., Curtiss Wright Corp., Utica, Mich.

MERCEDES-BENZ



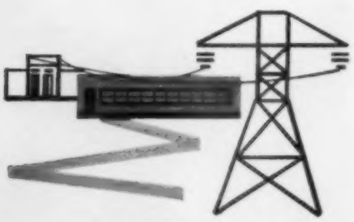
For added power with higher overall efficiency, the ALCO turbosupercharger is an integral part of each ALCO diesel engine in the 750-2400 hp range.

MARINE



PIPELINE

LOCOMOTIVE



POWER GENERATION

A BIG POWER BONUS is added to every ALCO diesel engine with turbosupercharging. ALCO first introduced diesel turbocharging in 1936, and today ALCO alone builds a complete line of engines and turbochargers as matched components. Proved in railroad, pipeline, power-generating, marine and oil-drilling service, a turbocharged ALCO 251 diesel in your next installation will provide the extra margin of profit that modern operations demand.

ALCO

ALCO PRODUCTS, INC.

TRANSPORTATION PRODUCTS DIVISION
SCHENECTADY, NEW YORK

DIESEL-ELECTRIC LOCOMOTIVES • DIESEL ENGINES • RENEWAL AND MODERNIZATION PARTS • REPAIR AND REBUILD SERVICES

WESTBURY WATER DISTRICT

By LEROY EBRIGHT*

FREEDOM from perennial hurricane–caused power failures and avoidance of high electrical demand charges have been achieved by combining diesel and electric power in the newest pumping station of Westbury Water District, Long Island, N.Y. Electrical demand charges only for high capacity electric motors, within 15 years, would exceed the cost of installing and operating the diesel engines.

Attractively landscaped, Westbury Water District's newest facility includes the building housing the well and booster pumps and a one and a half million gallon ground storage tank. This facility was put in operation the first of October, 1957.

Extremely high peak loads from 5 to 9 p.m. in warm weather for watering lawns and for the approximately 30,000 patrons of nearby Roosevelt Race Track necessitated additional pumping facilities. This unit includes a well (tenth now in operation), engines, pumps and a million and a half gallon ground storage tank. Water is pumped from well number 12, under the pumphouse, to the storage tank, just south of the building. A 50-hp General Electric three-phase ac electric motor powers a 10-in. Layne-Bowler deep well turbine pump. Turning at 1160 rpm, the pump can move 1050 gpm. During power failures caused regularly by hurricanes, the pump will become a prime source of water for the district. Standby power is supplied by a Caterpillar D318 diesel engine, connected directly to the pump. Although this engine is somewhat larger than required for the pump, it was selected for complete interchangeability with the other diesel engines in the installation.

Superintendent, Westbury Water District

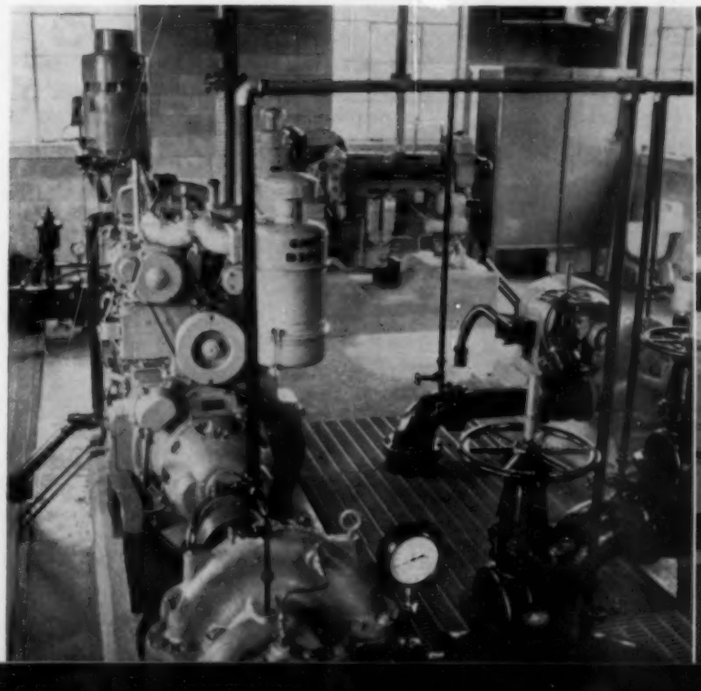
Up to 1,500,000 gals. of water can be held in the ground storage tank. This reinforced concrete tank, half underground, is 120 ft in diameter and 20 ft deep. Side walls are 16 ins. thick, the bottom 6 ins. thick, and the top 5 ins. thick. As the peak load begins to tax the entire system, a 60-hp three-phase Fairbanks Morse electric motor, powering a 6x5 F-M turbine pump, automatically starts to maintain the 160 ft line pressure. New Telemeter gauges and equipment located in my office across town gives warning of the rising consumption. Only a few minutes are needed to dispatch an operator to the pumphouse (well no. 12) to start up the two diesel-powered booster pumps.

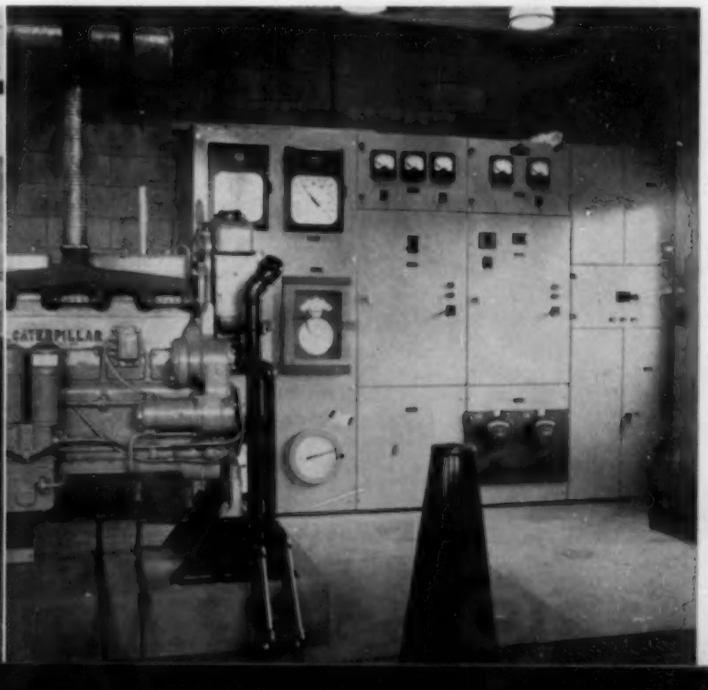
Two Caterpillar D318 diesel engines drive 8x6 DeLaval horizontal centrifugal pumps through a Snow-Nabstedt gear. At 1800 rpm, each pump produces 1600 gpm against a 160 ft head. The two diesel-powered and one electric-powered pumps can be combined to pump up to 4200 gpm to maintain the 160 ft line pressure. A Nash vacuum priming system keeps the pumps ready to work. Sufficient fuel for the diesel engines for more than a month's operation is provided by a 5000-gal. underground tank. This also permits purchasing tank-truck lots of fuel for greatest discounts.

This new facility has been under construction on a piecemeal basis for the past two years as funds have become available, and was put into operation the first of October. Part of the $300,000 required was available in budget funds, but the remainder had to be raised by a special bond issue. Angus D. Henderson, consulting engineer, designed this facility. The Layne-New York Company, Inc., drilled the well. S. F. Musselwhite, Inc., constructed the building, and D. Fortunato Inc., constructed the storage tank. Booster equipment was supplied and installed by the Turbine Equipment Co. Board of Commissioners for the Westbury Water District are Joseph J. Summa, chairman; Marvin C. Baldwin, secretary; and Joseph F. McKenna, treasurer.

Space, light and ease of maintenance and operations characterize the new pumping facility. Steel gratings down the center of the room provide access to the pipes. Controls for all three booster pumps can be easily reached from the center. The diesel and electric engines for the well pump extend across the far end of the room.

Operations are controlled through these Telemeter gauges, indicating flow from well No. 12 (under the station), line pressure, and pumping conditions. Board is connected with one in the superintendent's office, across town.



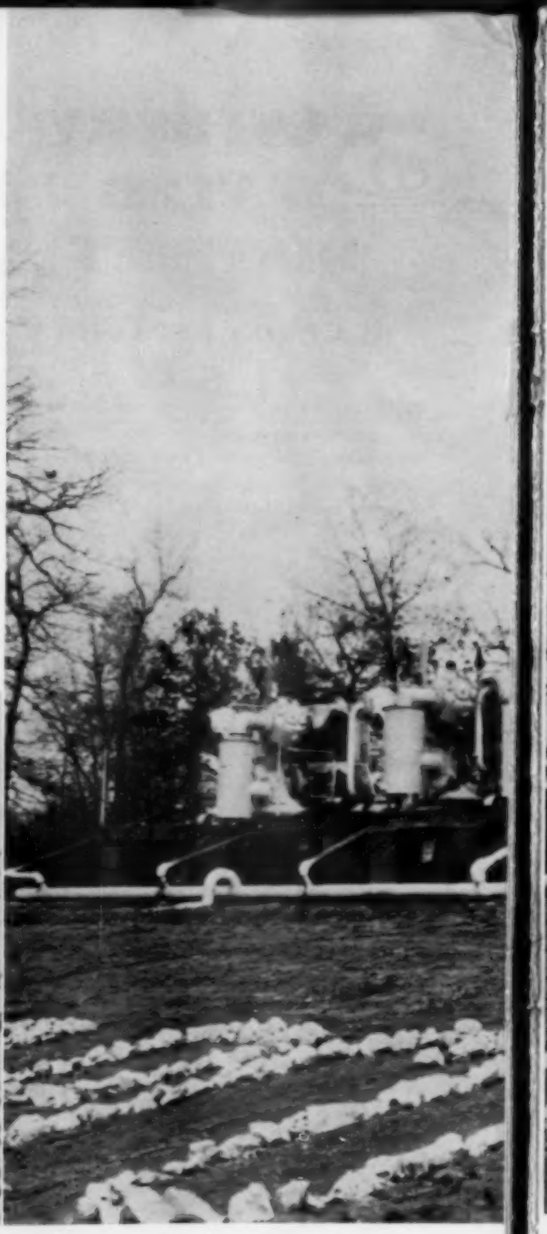


NEW OIL-WELL DRILLING SYSTEM EMPLOYS DIESEL AIR COMPRESSOR UNITS

By J. W. BROWN*

A WILDCAT venture in Atoka County, Oklahoma recently demonstrated the use of compressed air as a means of cutting operating costs and upping the penetration rate on high-speed oil drilling rigs according to information released by Well Completions, Inc., air drilling engineers of Denver, Colorado, and the Detroit Diesel Engine Division, General Motors Corporation in Detroit.

On the well in question, four trailer-mounted Joy air compressors, each powered by a General Motors Detroit Diesel Twin 6-71 engine were employed. The 2-stage, V-type compressors each have a first-stage bore of 13½ inches and a second-stage bore of 7 inches. The compressors are driven at approximately 833 rpm through 1.77:1 reduction gear boxes from the GM Twins which are governed at 1475 rpm. Each compressor unit delivers up to 820 cu ft/min at 300 lbs maximum pressure. Each trailer unit is self contained, bearing its own fuel supply in a tank mounted on the yoke of the low trailer. This obviously makes moving from rig to rig comparatively simple, eliminating problems of foundations, drive alignment, etc. Each compressor unit is equipped with special heat exchangers and moisture separators to condition the air as it enters the compressor system.



Four of the air-drilling compressor units owned by Well Completions, Inc., of Denver shown in action on an Atoka County, Oklahoma wildcat drilling operation.

End of the line for dust and rock particles brought from deep within the well by compressed air. Visible near the outlet is a gas "pilot light" provided as a safety measure, to ignite any natural gas which might be brought up with the air flow, before it accumulates to dangerous proportions.

drilling the units could be easily transported by barge.

Advantages claimed by Well Completions, Inc. for the air-drilling technique center chiefly around less wear on the drilling bit. Round trips—pulling thousands of feet of drill pipe out of a well to change to a new bit, and lowering it in again—are a major handicap to the driller since they represent unproductive time. Elimination of round trips to any degree can therefore make a substantial difference in the cost of drilling a well.

That comparisons are odious is particularly true of oil well drilling, due to the infinite variety of conditions encountered, area vs area and even hole vs hole. However, information released on the Atoka County well cites one drill bit as having been on bottom over 201 hours and relates that only 15 drilling bits were required to reach the 5,093-foot level as compared to 89 bits on another well in the area. A saving of nearly 50% in drilling time (39 days vs. 72 days) was also mentioned. One of the safety precautions used by Well Completions, Inc. in their work is to employ non-spark ignition diesel engines on their compressor packages. As originators of the air drilling service, they use a large number of GM Diesel Twins, all trailer-mounted, on their compressor applications.

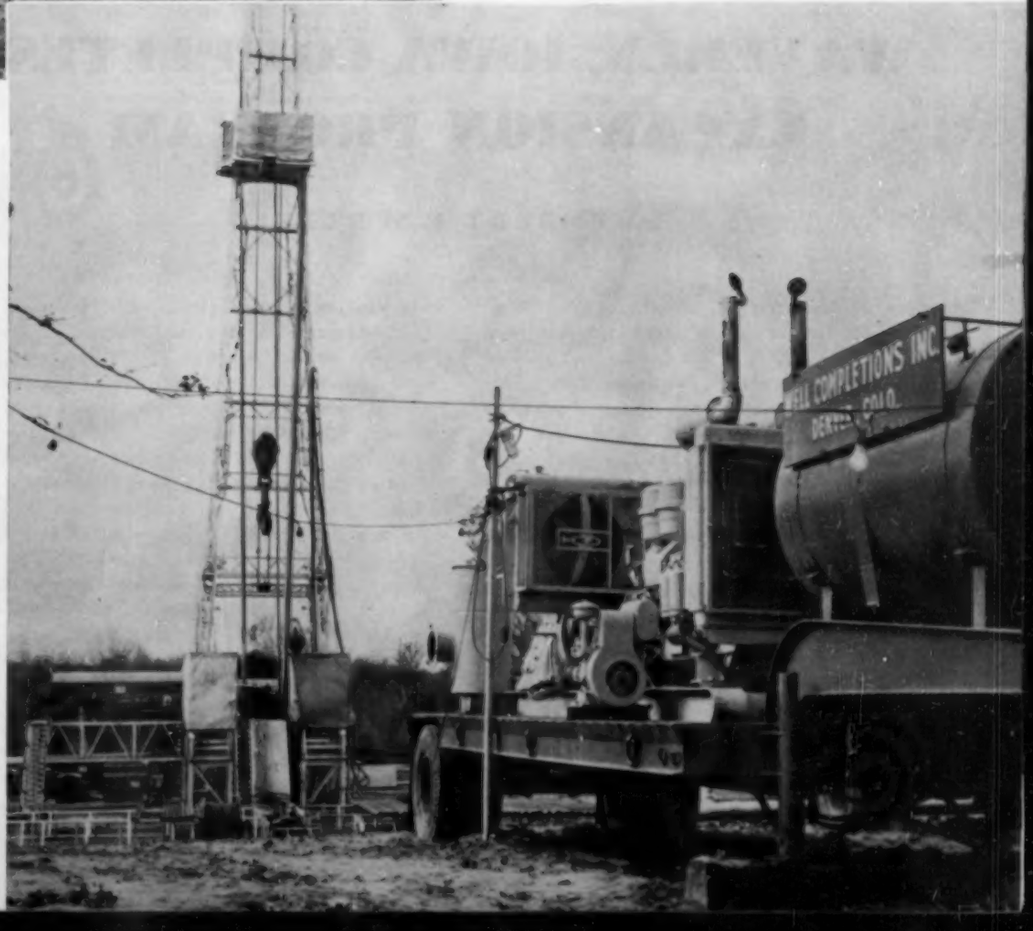
Midwest Editor

Close-up view of one of the four trailer-mounted air-drilling units.

The New Technique

The new technique for drilling offered by Well Completions, Inc., substitutes a blast of high pressure air for the mud commonly used to remove drill bit cuttings from the bottom of the well and to bring them to the surface. Compressed air furnished by the several units is gathered in a main and fed into the Kelly connection whence it passes down the drill stem and pipe, emerging through the drill bit below. The air then passes up the outer casing wall to the surface where it is released. The flow of air performs two functions: it carries the drill cuttings to the surface and helps to dissipate the frictional heat of drilling.

In the case of the Atoka County wildcat, air from the four compressor units was collected in a manifold from which it was conveyed to the drilling platform by means of a four-inch pipe line laid across the ground. Flexibility of the set-up is further evidenced by the fact that the compressor units can be mounted at some distance from the well and can make use of existing topographical conditions, often with a reduction of leveling effort and cost. In marshy conditions or for offshore



Mayor and City Council in front of the West Light Plant, Waverly, Iowa, where an Open House was held July 12 and 13, 1958, to celebrate a $651,000 utility expansion program. L. to r.: Councilmen Frank Curtis, Emil Roloff, William J. Schoof, Lauren Wedeking, Mayor John D. DeNeui, Councilmen Harold Frey, E. H. Kohlman, and Walter Zahn.

WAVERLY, IOWA COMPLETES EXPANSION PROGRAM

By ROBERT E. SCHULZ*

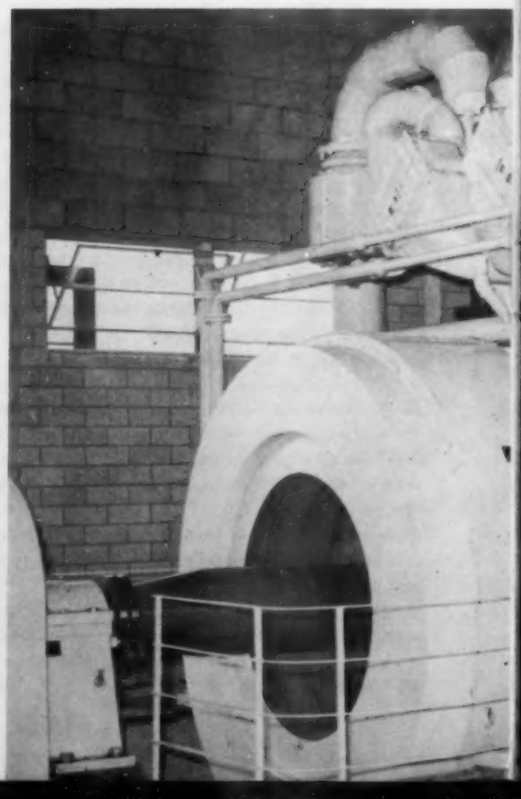
July 12—Waverly, Iowa, the city with a . . . "Plus", opened the doors of its municipal power plant today to hundreds of local, state and national visitors as it marked the completion of a $651,334 power development project. Center of attraction was the first U.S. installation of the new four-cycle, 16 cylinder RV-16 dual fuel diesel engine developed and manufactured by Enterprise Engine & Machinery Co. By far the biggest and most powerful engine Enterprise has built, the RV-16 has a 17 in. bore and 21 in. stroke and has a top rated capacity of 7,700 bhp at 400 rpm. The engine at Waverly is rated 4,890 bhp at 143 bmep, 360 rpm and drives a 3,500 kw Elliott generator.

Waverly, with a population of 6,500 is located in northeast Iowa on the Cedar River. The town was originally built around a rapid fall that made possible an early day flour and saw mill. Today Waverly's industry is well diversified and townsfolk speak with pride of its remarkable school system, excellent parks and playgrounds, good government and fine job opportunities. This pride is justifiable and manifests itself most strongly when the municipal power plant is being discussed. Undoubtedly the installation of the new Enterprise engine is an important milestone in the growth of Waverly's light and power system. The beginning of this public utility dates back to 1904 when the city purchased the holdings of the Healy Electric Light Co., an old hydro plant on the Cedar River. In the better than five decades that have transpired since that date the capacity has increased from 150 kw to Waverly's total plant capacity today of 9,440 kw. Of this total, 3,345 kw is installed in the East plant with power generated by four turbocharged Worthington diesels and three hydro units.

The new West plant has appropriately been called a "showplace among power plants in the nation" and certainly the new Enterprise further enhances its attractiveness. Its partners in power production are a pair of eight cylinder dual fuel Worthington engine-generator units with a combined capacity of 2,595 kw, which gives this plant a total of 6,095 kw and a dependable firm capacity of 5,445 kw. This, Merritt Bushby, Waverly Superintendent of Utilities reports, "will be more than enough for the city's immediate needs and reserves for several years to come." The plant this year has already reached a peak load of 4,200 kw.

According to Bushby, the plant in 1957 generated 18,148,000 kwhs compared to the total generation in 1940 of 3,211,100 kwhs. Sales of electricity in 1957 amounted to $403,361.53 compared to $105,351.00 in 1940. Projecting these figures, Bushby expects the plant to be generating 35 million kwhs in 1968 with sales at about one million dollars. The plant currently serves 2,282 residential, rural, commercial and power users over an aggregate of 250 miles of distribution line. According to the city's 1957 financial report, total revenue was $1,209,518.67 with $162,874.36 net profit. Purchase of the new Enterprise engine was financed through issuance of revenue bonds and payment on the bonds is made from light plant revenue.

The Enterprise engine for its capacity is un-



*Managing Editor—Diesel Progress

Rear view of West Light Plant, Municipal Electric Utility, Waverly, Iowa, showing Arrow Industrial Mfg. Co.'s Transaire water cooling equipment and Maxim exhaust silencers for the new Enterprise RV-16 cylinder, dual-fuel engine.

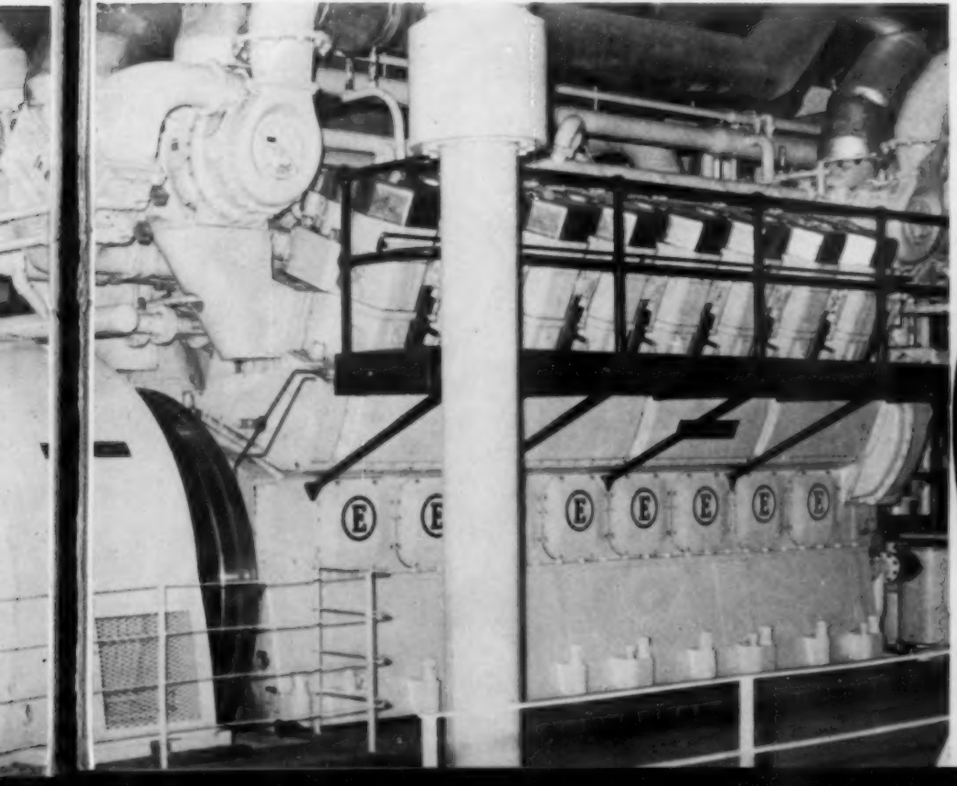
usually compact in its appearance and occupies only slightly more floor area than the 1,245 kw units. It is equipped with four Brown-Boveri VTR 320 turbochargers with a pressure ratio of 1.6 and drives a 3,500 kw, 3 phase, 60 cycle 2400-4160 volt, 360 rpm Elliott generator. With its official acceptance today it has already run 800 hours and generated 1,669,000 kwhs. It burns natural gas having 1000 btu/cu ft and pilot oil in the proportion of 5 per cent. Though this is the first domestic installation of the new Enterprise engine, there are several units of the same type operating in the Middle East. One is now being installed in the municipal power plant in Ottawa, Kansas and contracts were just signed with the Wolverine Electric Co-op in Michigan for the early delivery of an RV engine.

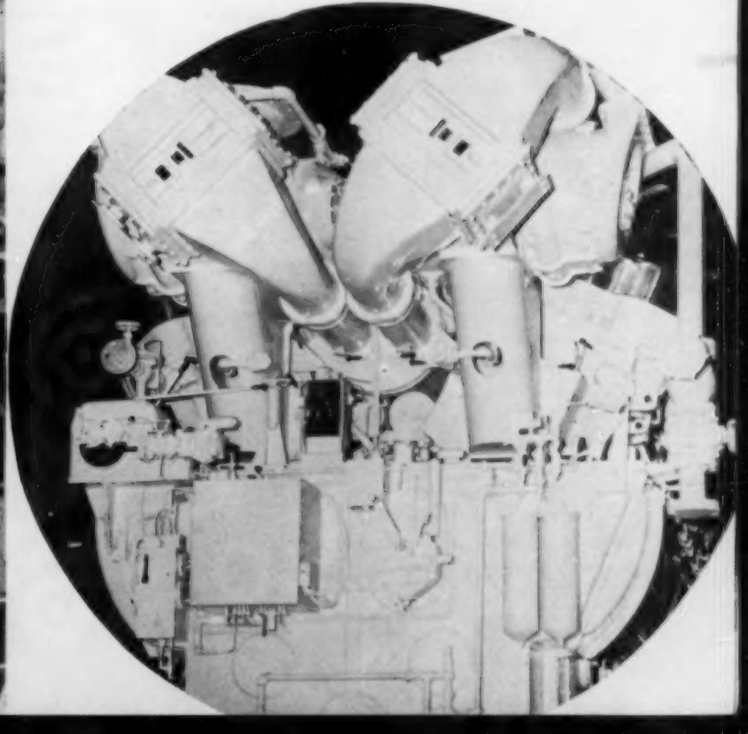
The decision to manufacture a large diesel engine of approximately 5,000 horsepower or better was made by Enterprise executives in mid-1954. Working under the direction of Bruce Robbins, Manager of Engineering, and John Sheusner, Manager of Operations, principal designers Don Morris, Henry Hirvo, and Harold Schilling began the long and expensive process of development. Some consideration was given initially to a 20 in. bore and 25 in. stroke, 8 cylinder engine. However, it was decided that a V-16 using Enterprise R series engine parts would have many advantages in relation to total weight, cost, size and hence smaller plant structure and foundations. In the design of any internal combustion engine, Robbins made it clear, the first consideration in planning the production of a new engine must be structural rigidity which controls the smoothness of operation as well as the durability of the wearing parts. "We aimed at keeping the engine as short as possible," Robbins said, "consistent with the provision of adequate bearing surfaces for the crankshaft and adequate cooling of the cylinders and cylinder heads."

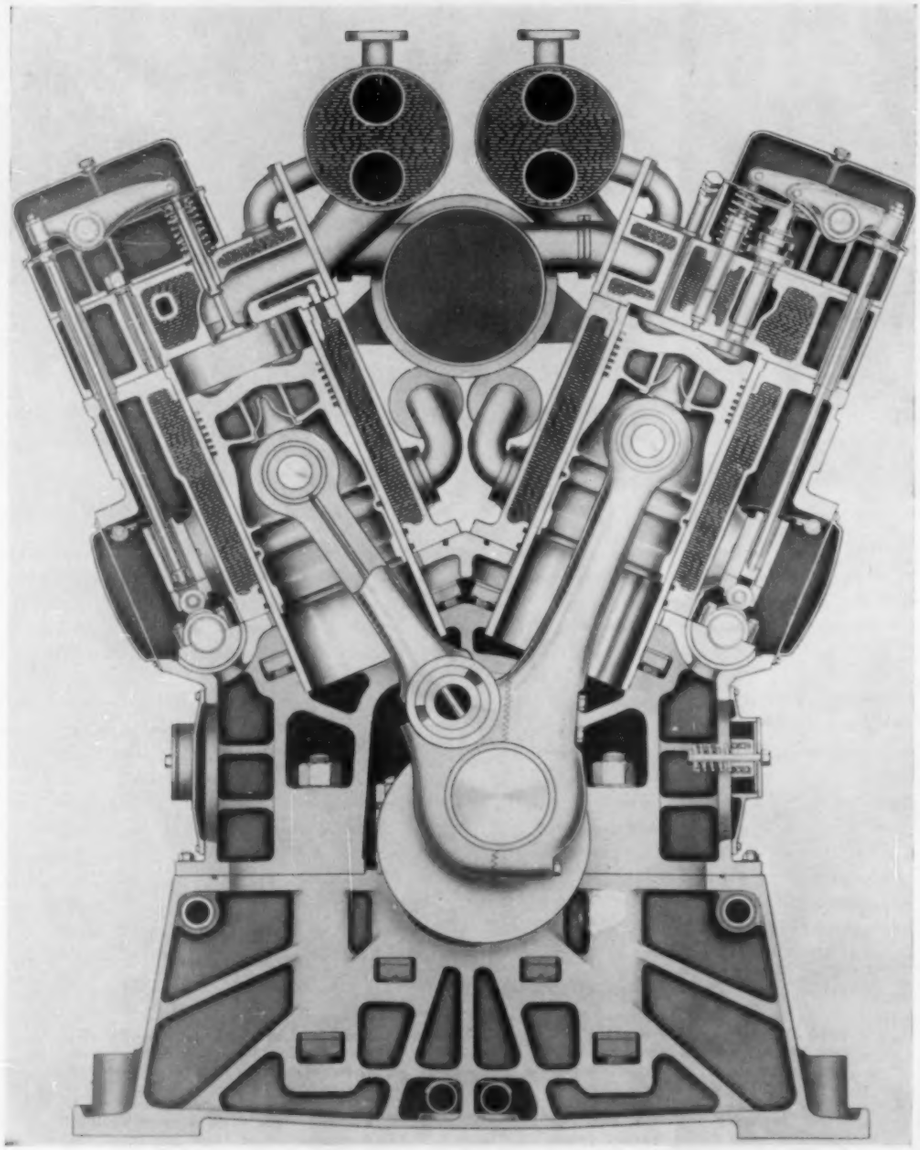
It was decided, therefore, to maintain the standard "R" series cylinder center distance of 24 in. not only for reasons of structural rigidity but also to provide for a maximum interchangeability of parts. "This was a major decision," Robbins declared, "inasmuch as it necessitated the design of a novel type of construction for the connecting rod to keep all of the bearing and bushing loads to conservative standards." Conventional side by side rods, with offset cylinders, could not be used because of reduced bearing area or the need for increasing the engine length 5 feet, an increase of 27 per cent. Fork and blade rods were ruled out because there would not be enough distance in the length of the crankpin for the required number of bolts and boss metal, without increasing the engine length 2¼ ft., a 12 per cent increase. Articulated rod construction was chosen, therefore, and the final design of the RV-16 as it evolved has a considerable number of advantages with these considered major: (1) removal of 6 bolts permits the master rod to be pulled out of its cylinder bore and the link rod and its half of the box to be removed thru the cylinder bore in the opposite bank; (2) a greatly increased crank pin diameter is permitted; (3)bearing box may be as rigid as desired with no compromise because of removal through the cylinder bore; (4) increased crank pin

4,890 hp Enterprise RV dual-fuel engine at Waverly is equipped with four Brown Boveri turbochargers and drives a 3500 kw Elliott generator with a 30 kw, 1750 rpm dc Elliott exciter featuring a Poly-V belt. Air entering each turbocharger passes through a Kittell air filter.

Front end of the Enterprise RV engine showing the Brown Boveri turbochargers and air coolers, Woodward governor and Winslow fuel oil filters. Westinghouse Air Brake controls provide automatic switch-over to straight oil operation in event gas supply is interrupted.







This schematic shows the compact arrangement of the Enterprise engine. Note master and link connecting rod, cylinder and head arrangement which permits removal of piston and connecting rod out through the top, and positioning inside the V the manifolds which require little service. Parts requiring service are on the outside and accessible.

diameter permits the use of re-entrant fillets with additional increased connecting rod bearing area; (5) link pin is the same diameter and has the same bearing area as the piston pin and (6) the 6 bolts are not directly stressed by combustion load, but only serve to hold the rod and box together, with the combustion load being taken by rack gear teeth at the parting surface. In addition, the Enterprise RV-16 provides for a new oiling system which eliminates the groove in the upper half of the connecting rod bearing and the lower half of the main bearings, giving an increased bearing area.

All of these additions to the bearing area, together with a better load carrying capacity created by groove removal, and hence a better length and diameter bearing ratio, add up to a calculated increased load carrying capacity compared to the R engine of more than 2.8 times. The new oiling system used on the RV-16 provides a greater flow of cooling oil to the pistons required by the increased ratings. Inertia pressure set up by a column of oil in the connecting rod far exceeds the normal oil pressure and it was necessary to prevent a return flow into the crank pin bearing. This was done by using the crankshaft itself as a rotary valve, a design chosen in order to eliminate the use of any additional or vulnerable moving parts and to tie in with the removal of the oil groove in the most highly loaded halves of the bearings. The crankshaft on the RV-16 is very rigid, having 13 in. dia. main journals and 12 in. dia. crankpins and these overlap 2 in. The web is 26 in. in dia. The crankshaft is so rigid that re-entrant fillets are allowable by A.B.S. formulas and this permits greater area on both connecting rod and main bearings. The cast iron engine is composed of a base, a crankcase, and two identical cylinder blocks, a type of construction that facilitates handling during the manufacturing, the assembling, shipping and at the installation site.

The new RV-16 is the largest diesel engine ever built on the West Coast. Weighing 110 tons, it stands 12 ft. 8 in. high. Its length from turbo to turbo is 22 ft. 8 in. and its width is 9 ft. 4 in. In spite of its comparatively large size, as heavy duty diesel engines go, it still is said to be the smallest diesel in the world rated at 7,700 hp. It is the fifth in the series of engines now being built by Enterprise to serve a wide variety of power needs, both stationary and marine.

The Enterprise RV engine not only has the same bore and stroke as its R series in-line counterpart but it also measures up with the same cylinder center distance. Although a V-type, the connecting rods from both cylinder banks have a greater bearing area on the crankshaft than does the inline engine. It is the special design of the RV that shortens engine length and yet provides plenty of bearing area. This design involves the master and link connecting rod, an articulated pair of connecting rods, a "link" rod that bears on a "master" rod which in turn bears on a single crankpin. Thus, each of the crank pins does double duty with the RV-16, transmitting the thrust from one piston of a pair each time the crankshaft turns. In effect, the result is a two-cycle crankshaft powered by 4 cycle pistons. All of the push rods, tappets, camshafts, fuel injection pumps, and fuel headers on the RV-16 have been located in such a manner as to be easily accessible for maintenance and servicing. Manifolds and water headers are mounted inside the V.

Normally aspirated or turbocharged, the RV can be furnished to operate on diesel or heavy fuel, as a dual fuel engine, as a spark-ignited gas engine, or as a tri-fuel plant capable of burning diesel oil alone or gas ignited either by pilot oil or by spark. The Waverly RV as mentioned is a dual fuel unit.

The actual installation of the new RV-16 at Waverly's West Light Plant including foundation preparation, was handled by Enterprise representatives, the Power Equipment Co., of Kansas City.

Equipment Serving Enterprise Engine

Generator & Exciter	Elliott
Governor	Woodward
Air filters	Air Maze
Lubricating oil filter	Hilliard
Turbochargers	Brown Boveri
Safety controls	Amot
Cooling tower	Dover
Silencers	Maxim
Lubricating oil	Sinclair
Fuel oil	Sinclair
Fuel injectors	Bendix-Scintilla
Pyrometer	Alnor
Lubricating oil pumps	Viking
Radiators	Arrow
Switchgear	General Electric
Control board	Associated Consultants
Fuel oil filters	Winslow
Oil coolers	Ross
Jacket water pumps	Woodin & Little
Turbo air filters	Kittell
Rubber couplings	Goodyear

M/V *ALEXANDER T. WOOD*

By DWIGHT P. ROBISON

THE M. V. *Alexander T. Wood* built by Canadian Vickers Limited, Montreal, successfully completed her sea trials during the third week in April and was recently handed over to her owners, Westriver Ore Transports Limited, Montreal. This vessel is one of the largest ocean-going dry cargo carriers so far built in Canada, and is believed to be the largest in the world specially designed for both deep sea and Great Lakes service. H. C. Downer Associates, the owner's design agent, worked closely with the yard in developing her design and supervising construction.

It is intended that the *Alexander T. Wood* will operate on the ore carrying run between the St. Lawrence River Ports of Seven Islands and Contrecoeur during the summer and early fall, and will then revert to ocean-going operations during next winter. With the opening of the St. Lawrence Seaway, scheduled for the spring of 1959, the vessel is expected to operate through to the Great Lakes, but the owners have indicated that this will depend upon the type of toll and pilotage structure finally applied to Seaway users.

The *Alexander T. Wood* has been built to Lloyd's Classification 100A1 for electric welded construction and is suitably strengthened in accordance with Lloyd's Rules for the carriage of heavy cargoes. The requirements of the British Ministry of Transport, Canadian Steamship Inspection and International Regulations for the Safety of Life at Sea, have all been complied with in her design and construction.

Principal dimensions are as follows: Length Overall, 578 ft 0 in.; Length B. P., 550 ft 0 in.; Breadth Moulded, 72 ft 0 in.; Depth Moulded to Upper Deck, 42 ft 6 in.; Deadweight at Maximum draft of 30 ft 0 in., Approx. 20,000 tons. Trial speed at 30 ft 0 in. draft, Approx. 13½ knots.

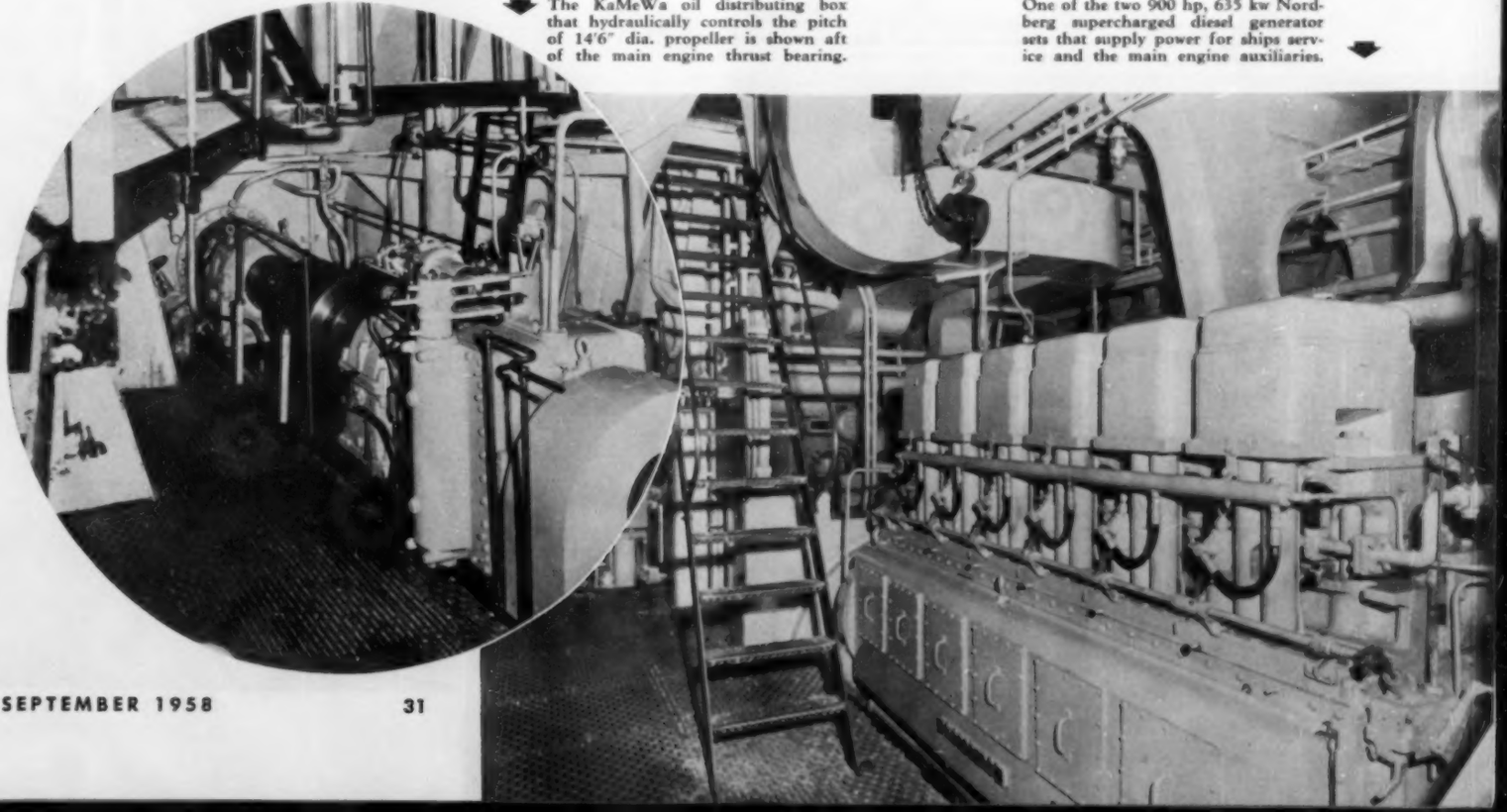
The *Alexander T. Wood* is of the single deck type with Poop and Forecastle, and the accommodation, navigating bridge and machinery is arranged at the aft end, the hull being divided into fore peak, deep tank, six cargo holds, machinery space and after peak. The diverse conditions of service to be encountered by this vessel have led to the incorporation of many special features in her design, some features being commonly found only on Great Lakes vessels, others only on ocean going vessels; while certain design features have been specially devised to suit St. Lawrence Seaway navigation. Notably among the latter is the propulsion system, which involves the utilization of a 6800 hp Nordberg non-reversing diesel engine which burns heavy oil, and is direct coupled to a variable pitch propeller, controllable from the wheelhouse. This power plant was decided upon after a careful study by the owner's design agent, H. C. Downer & Associates of Cleveland, Ohio, in joint discussion with the engine manufacturers and the shipbuilders. The Study showed this system to be the most adaptable and economical for the service intended.

Built to Nordberg's two-cycle, port scavenging design, the propulsion engine has eight cylinders of 29 in. bore and 40 in. stroke. It develops its rated horsepower at 168 rpm and is direct-connected through a flexible coupling to a 14 ft 6 in. diameter KaMeWa controllable-pitch propeller. The power plant is designed to burn the heaviest type of bunker oil to be encountered and the latest equipment is employed for this service. An array of purifiers, clarifiers, filters and thermostatically controlled heaters supplied with steam generated from the exhaust of the main engine insure that the oil is properly treated before it reaches the viscosity instruments ahead of the engine injectors. The oil conditioning equipment is designed to discharge the sludge removed from the oil automatically at regular intervals thus maintaining the purifying efficiency at a high level and keeping maintenance work to a minimum. The operators are thereby insured of the savings resulting from the considerably lower cost of Bunker Oil as compared to diesel oil and of the extra revenue from the additional tonnage which can be carried due to the higher economy of the power plant in the vessel.

The controllable pitch propeller built by KaMeWa with stainless steel blades is believed to be the first one application on an ore carrier or to a vessel of this size. The four blades can be reversed quickly by remote control, either from the maneuvering position in the engine room or directly by the captain on the bridge. Unlike the conventional type of propeller, it is possible to obtain full power whatever the weather conditions, as the blade can be positioned according to the resistance

The KaMeWa oil distributing box that hydraulically controls the pitch of 14'6" dia. propeller is shown aft of the main engine thrust bearing.

One of the two 900 hp, 635 kw Nordberg supercharged diesel generator sets that supply power for ships service and the main engine auxiliaries.



offered to the vessel and the engine speed kept at its maximum. It will also be possible to approach and enter a lock at extremely slow speeds by adjusting the pitch to a very small value, even approaching zero, while the engine is kept turning at a constant speed ahead. All this of course is made possible by a hydraulic governor on the engine working in conjunction with the propeller controls to achieve close regulation of the fuel supply for the engine.

Two large generators, each capable of 635 kw continuously, driven by supercharged Nordberg diesel engines rated 900 hp, 450 rpm are installed. Alternating current is used and the main load on the generators consists of large motor driven centrifugal blowers which supply combustion air to the main engines.

The distribution system is 440 v 3 phase, 60 cycle ac 3-wire for the power circuits, and is stepped down by marine type transformers to 115 volt single phase for lighting circuits. Under-voltage relays combined with time relays have been fitted to all important auxiliary equipment so that in case of power failure due to loss of voltage, when power is restored, each one of these auxiliaries will come back on the line automatically and at a predetermined interval of time.

The transverse bulkheads between the holds are corrugated vertically in accordance with modern practice, and longitudinal bulkheads, having vertical stiffeners attached on the outboard sides, form wing water-ballast tanks port and starboard, the length of the cargo holds. Double bottom water-ballast tanks are arranged under Nos. 1, 2, 3 and 4 holds, oil fuel under Nos. 5 and 6 holds, diesel oil under the aft end of No. 6 hold and under part of the engine room.

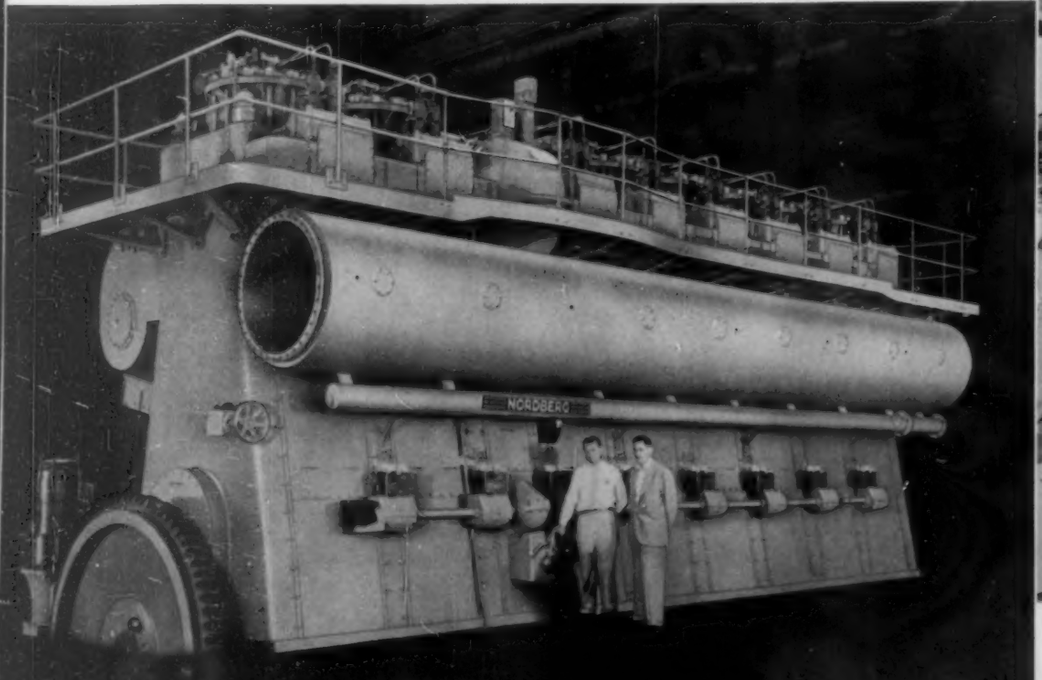
The vessel is constructed on the combined transverse and longitudinal framing system, longitudinals being fitted to the upper deck in way of cargo holds, and to bottom shell and tank top plating in double bottom spaces. A longitudinal tunnel with suitable access and walkway is carried through the wing tanks on each side of the vessel under the upper deck. These tunnels are used for the various piping systems and electric cable leads extending forward. They also house the electric motors and operating gear for the wing water ballast filling and discharge valves. Each hold is served by a large hatch, 40 ft 0 in. wide, having McGregor Patent Steel Hatch Covers of the single pull type.

Three Stockless bow anchors are carried, and also a 53¾ cwt. stern anchor of similar type. The bow anchors are handled by an electric hydraulic windlass capable of lifting one or both anchors at a speed of 30 ft per minute. The stern anchor is handled by an electric-hydraulic capstan which also has a speed of 30 ft per minute and in addition a warp pull of 10 tons at 35 ft per minute. Four electric hydraulic mooring winches, constant tension type, are located on the upper deck, two forward and two aft, each with remote ship side controls. Eight fairleads are also fitted.

The steering gear has been manufactured by Messrs. Hastie and is of four ram electric hydraulic type, with 2 pump motor units and operated by telemotor from the wheelhouse. Local control is arranged for emergency steering. The rudder is of semi-balanced, double-plate streamlined type, with a forged steel stock. A "Brown" gyro compass is fitted in a special room on the Upper Deck, with repeaters in the wheelhouse and one in the Captain's office. Two bearing repeaters are mounted in the wings of the navigating bridge. A standard compass of reflector type is located on the wheelhouse top. The vessel is also equipped with radar, wireless, D/F equipment, ship to shore radio telephone and echo-sounding.

As previously stated, all the accommodation is arranged at the after end. On the upper deck, single-berthed cabins are provided for carpenter,

The big Nordberg two-cycle non-reversing diesel that propels the *Alexander T. Wood* is shown here prior to shipment from the manufacturers plant. Note Manzel mechanical lubricators.

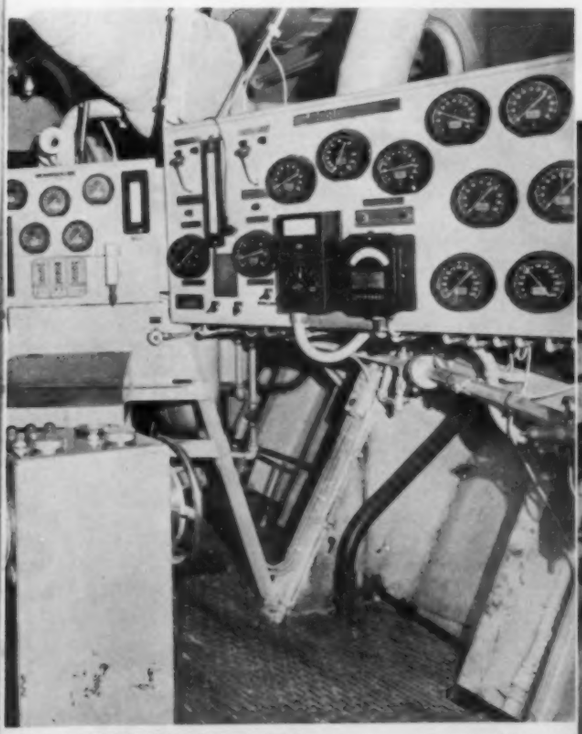


bosun, nine seamen, three oilers, two wipers, chief cook, two stewards and one cook; and one double room is provided for two messmen. Separate washrooms with showers are arranged for P. O.'s, seamen and stewards. On the poop deck, single rooms are arranged for the Chief, 2nd and 3rd Officers, 2nd, 3rd and 4th Engineers and three junior engineers, also for the Chief Steward. A hospital with separate W. C. and bathroom is also arranged on this deck as is the crew's cafeteria. From the galley, a stairway leads down direct to the provision room and cold stores on the upper deck. The Captain's and Chief Engineer's suites and two staterooms, each accommodating two passengers, are located on the boat deck together with the lounge and dining saloon. Accommodation for a radio officer and for two pilots is provided on the upper bridge deck, together with the Radio Office.

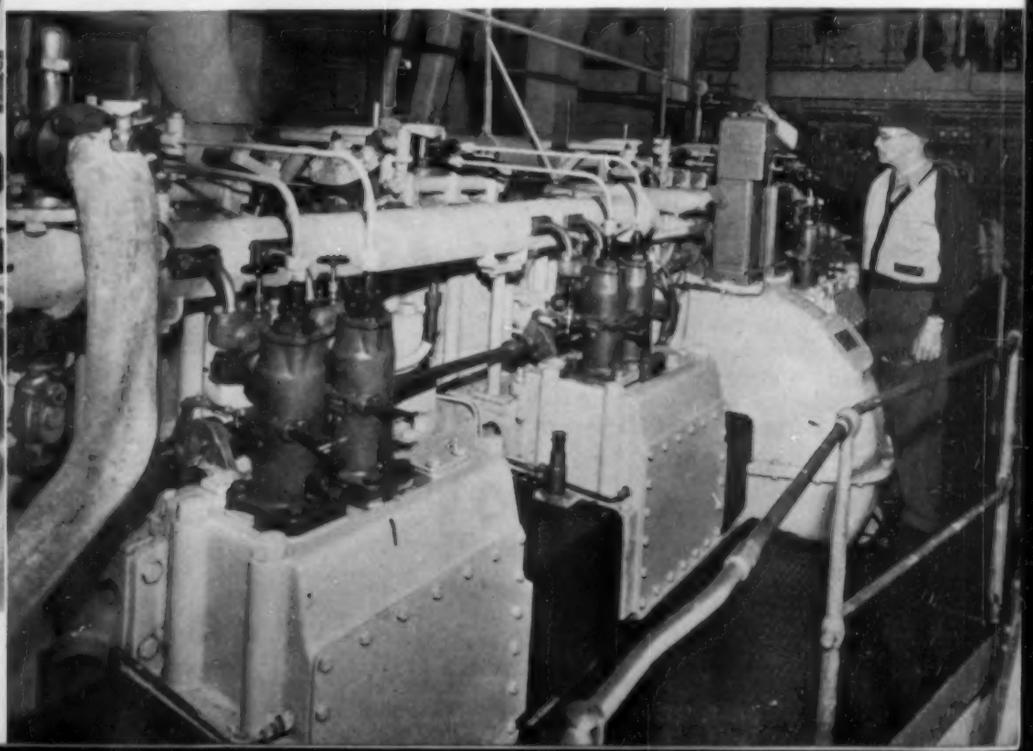
List of Principal Equipment

Main Engine	Nordberg
Ship's Service Generator Engine	Nordberg
Ship's Service Generators	Westinghouse
Auxiliary Generator	General Motors Detroit
Controllable Pitch Propeller	KaMeWa
Lube Oil Centrifuge Purifiers	Westfalia Separator
Heavy Fuel Oil Purifier	Westfalia Separator
Main Engine Fuel Oil Heaters	Ross
Diesel & Fuel Oils, Lubricants, Etc.	Shell
Governor	Woodward
Injection Equipment	American Bosch
Pyrometer	Alnor
Mechanical Lubricators	Manzel

Stand in the foreground of the engine room provides another operating station where engine speed and propeller pitch can each be separately controlled. To the left is the operating side of the Nordberg propulsion engine. To the right is the gauge board with Alnor pyrometer, manometer, shaft revolution indicator and pressure and temperature instruments for water, fuel and lube oil, starting air, etc.



Operator adjusts the Woodward governor stationed on the upper platform of the 6800 hp Nordberg Diesel. American Bosch fuel injection pumps are installed two per cylinder.



THE PALMETTO BY-PASS

By ED DENNIS

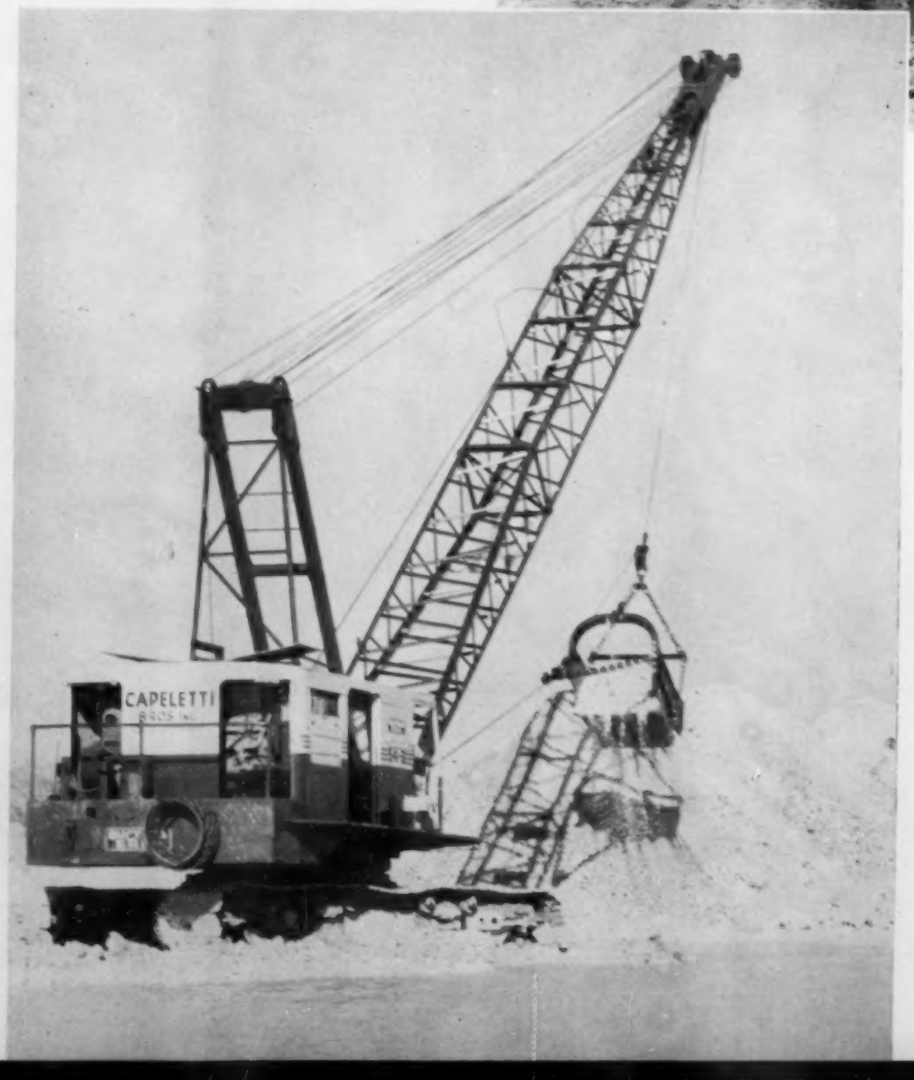
THE first section of the Palmetto By-Pass, designed to keep through city traffic away from Miami and its adjacent Gold Coast sister cities, is nearing completion. The slow work of excavating, moving and grading over a million cubic yards of material is finished. The road project begins at the Golden Glades Interchange, which is the southern terminus of the Sunshine State Parkway, runs due west about 7 miles where it turns south in a wide curve for almost 5 miles through what was barren flat sand and muckland to join U.S. Route #27 west of the City of Hialeah. The construction job was awarded on a joint venture project to R. H. Wright & Sons, Inc. of Fort Lauderdale and Capeletti Bros., Inc. of Hialeah for $2,705,578.21. The contract awarded to the two firms allowed 400 working days for completion, but, said, Andrew J. Capeletti, president of Capeletti Bros. Inc., "due to the considerable number of pieces of dieselized equipment used on the job and the good operational team work we have on this project we probably will be finished long before the deadline". Mr. Capeletti is a hard hitting young man moving up fast in this highly competitive road construction game, who in less than 10 years of operation, parlayed one dump truck into a million dollar organization moving over three and a half million cubic yards of dirt each year.

Two of the most important items done in the early phases of construction consisted of the handling and removal of about 838,000 cu yds of rock material from borrow pits etc. and 228,000 cu yds of muck and sub soil. Much of this work was done by a fleet of 6 dozers consisting of an Allis-Chalmers HD15, two D8 and two D7 Caterpillar tractors and an International TD24. Working as a team the work consisted chiefly of pushing aside the muck overburden to a few feet in depth. But on several locations where the muck was excessively deep, the Capeletti engineers moved in their new 543 Bucyrus Erie 3 yd dragline powered with a 281 hp Allis-Chalmers diesel engine, to handle the material and stock pile it for future use.

One of the biggest headaches was the relocating of about four and a half miles of the old Peter Pike Road and its drainage canal. It was obliterated by digging out the right of way and replacing with hard rock fill. The new canals dug along the new route acted both as borrow canals and as part of the Central and Southern Florida Flood Control District program. Several dieselized draglines operated along the new borrow canal dug and stock piled the rock material. The stock piles were serviced by 12 yd dump trucks and these were loaded by a Michigan 375A Cummins dieselized front loader with a 6 yd bucket and two 2½ yd Michigan 175A loaders with Waukesha diesel engines. With this tremendous amount of mechanical equipment being used plus the short distance of only about a mile, the several dozers and motor graders leveling the lime rock were able to work continually without interruption. The new road has a 350 foot right of way and when completed will be a divided four lane highway with two 24 foot road beds separated by a grassy 40 foot median strip. It is of the limited access type with 24 foot service roads on each side in several areas. As South Florida topography presents so little hydraulic gradient several drainage canals had to be dug to fit in with the overall drainage program of the Central and Southern Florida Flood Control Program. This required the construction of 11 bridges along the new route where most of the 442, 410 pounds of reinforcing steel needed was used.

The surface pavement will be of approved asphaltic concrete type #1 and about 500,000 sq yds will be used. The base material will be 495,232

The 54B three yd Bucyrus-Erie dragline with a 90 foot boom, powered with a 6DC1879 Allis-Chalmers diesel rated 281 at 1200 rpm. It has Twin Disc clutch and De Luxe oil filters. E. White is the operator for Capeletti Bros.



One of the many dieselized Bucyrus-Erie draglines working the new borrow canal which will run parallel to the new highway. It is powered with a Caterpillar D342 and a Twin Disc clutch.

Some of the equipment used on an average working day included a half a dozen draglines, six dozers, three graders, two loaders, two pans, fourteen dump trucks, one mixer, three cranes, two barges, three water pumps, two air compressors, a pile driver hammer, a generator unit and a portable welding outfit. Walter Leaf, maintenance equipment superintendent of Capeletti Bros. is responsible for keeping the equipment in tip top shape thereby insuring getting the most out of each piece of mechanical equipment.

The new highway is really a feeder road for the Sunshine State Parkway except that it is toll free and by using the combined facilities of the two roads the motorist or trucker will be able to by-pass the traffic congestion of the dozens of small Gold Coast cities. It will mean increased life for brakes and clutches, a reduction in truck insurance costs along with some reduction of engine overhaul frequency. Worn rings and oil clogged pistons are the toll imposed by the overheating of engines as the big tandems grind their way north and south through an endless succession of stops and starts. Just how rapidly the new expressway will be extended to its final destination with U.S. #1 at Kendall is problematical. While the State Road Department has set aside $4,800,000 in its 1957-58 budget it is up to the County to dig into its pockets for funds for the rights of way.

The dynamite rig mounted on a half track truck. The Ingersoll-Rand air compressor is powered by a 4 cyl. General Motors series 71 diesel engine.

Team work showing the model 375 six yd Michigan front loader powered with a NRT6BI Cummins rated 300 hp. Owned by the R. H. Wright & Sons Co. loading a Capeletti Bros. 12 yd dump truck with rock material from one of the many stock piles. The scoop on this loader is 12 feet wide.

yards of 8½ in. compacted lime rock placed on 12 in. of stabilized subbase rock compacted to a Florida bearing of at least 75 psi. This type of construction and paving has been selected because of its suitability in this area and for its economy in construction and maintenance.

MOBILE POWER CARS SPEED CONSTRUCTION OF MILLION-HORSEPOWER ALCAN POWER PROJECT

ACCORDING to the schedule of Aluminum Company of Canada, Ltd., the $150,000,000 Chute des Passes hydro-electric power project should be on power around August, 1959. But the record-breaking rate at which tunneling crews are working indicates the new installation may well be delivering power ahead of schedule. An important reason for this happy possibility has been the use of a relatively novel means of supplying start-up and standby power at the construction site—three 1000 kw capacity Electro-Mobile power cars. Ready availability of adequate power facilities got the project off to a flying start with rapid and maximum utilization of manpower and machines—and avoided the familiar agonizing build-up of men and equipment, complaints and discomforts due to inadequate heat and light, equipment stoppage and similar troubles. So reports Perini-McNamara-Quemont Construction Companies, the consortium of three companies acting as general contractor for the project.

It takes power to build power—especially when the power to be built is as big as Chute des Passes. With an installed capacity of 1,000,000 hp, the project will be equipped with what is believed to be the five biggest hydro-electric units in the world. The 100 mile long transmission lines will operate at 345,000 volts, one of the higher transmission voltages in the world in general use.

The project involves construction of a 6 mile long, 34 ft high and 34 ft wide horseshoe-shaped supply tunnel; a 1½ mile, 48-ft tailrace tunnel; underground power house and permanent housing facilities. Power facilities were required immediately for illumination and heating of camp sites situated at three tunnel adits and for the operation of electrically-driven heavy equipment such as compressors and shovels. But where was the power to come from? Chute des Passes is located on the upper Peribonka River in Quebec on a site 150 miles from the nearest railhead and transmission lines. Construction was scheduled to begin in the Fall of 1956, and the contractor's work force would rapidly build up to 1,500 men, and ultimately to 3,000 men—not counting wives and children of the men bringing their families to the job site.

In effect, on major "change the face of nature" type projects, the contractor must literally create a functioning civilization amidst the wilderness. Much time, energy and money is wasted during a project's early stages because of the need to build up a base of operations from scratch—with the attendant discomforts. An easily accessible source of power in adequate quantity can help avoid some of these difficulties. As the initial power source, the Perini group utilized three General Motors diesel-electric Mobile Power Cars. Starting October, 1956, and for the next 6 months the three units operated 24 hours a day, seven days a week at full capacity and sometimes even higher than rated capacity.

The first of the machines arrived at Isle Maligne, the nearest railhead, on Oct. 14, 1956, and was moved to a powerhouse belonging to Alcan, where it was disassembled. Assembled, the unit weighs 157,000 pounds, but weight restrictions on the old logging road to the site limited passage to a trailer with a 20 ton load. A 100 ton overhead crane was available in the powerhouse for use in dismantling. Major components were the welded housing, switchgear, engine, generator, cooling compartment and control cabinet. Railroad trucks were removed and left behind. Disassembly was completed in four days and components were loaded on seven semi-trailers and a 3 ton truck for the 150 mile trip to the site. The condition of the road is indicated by the fact that it took 36 hours to travel the distance. At one point, a river had to be forded at a depth of approximately 2½ ft. A crawler tractor first went ahead to level the bed of the river; then each load was "escorted" across with the help of a tractor front and back. The river crossing took almost seven hours.

Re-assembly at the job site was more difficult because of the lack of handling facilities. Nevertheless, five men with the help of a 35 ton truck crane assembled the unit and had it aligned and ready for operation in less than a week. A pyramid of 12 x 12 timbers over three feet of packed gravel was used as a base. As a result of the experience gained with the first unit, the Perini team was able to cut the total cycle time for the second and third units from two weeks to ten days. November 1, adit #1 was under way; adit #2 was started on November 12; and adit #3 on December 4. Except for one stop during Christmas, the

Power car at #1 adit is equipped for full automatic operation, including starting, stopping and protection against line shorting, hot engine or low lube oil. Starting and stopping can be accomplished by a time clock or through supervisory control using a dial telephone.

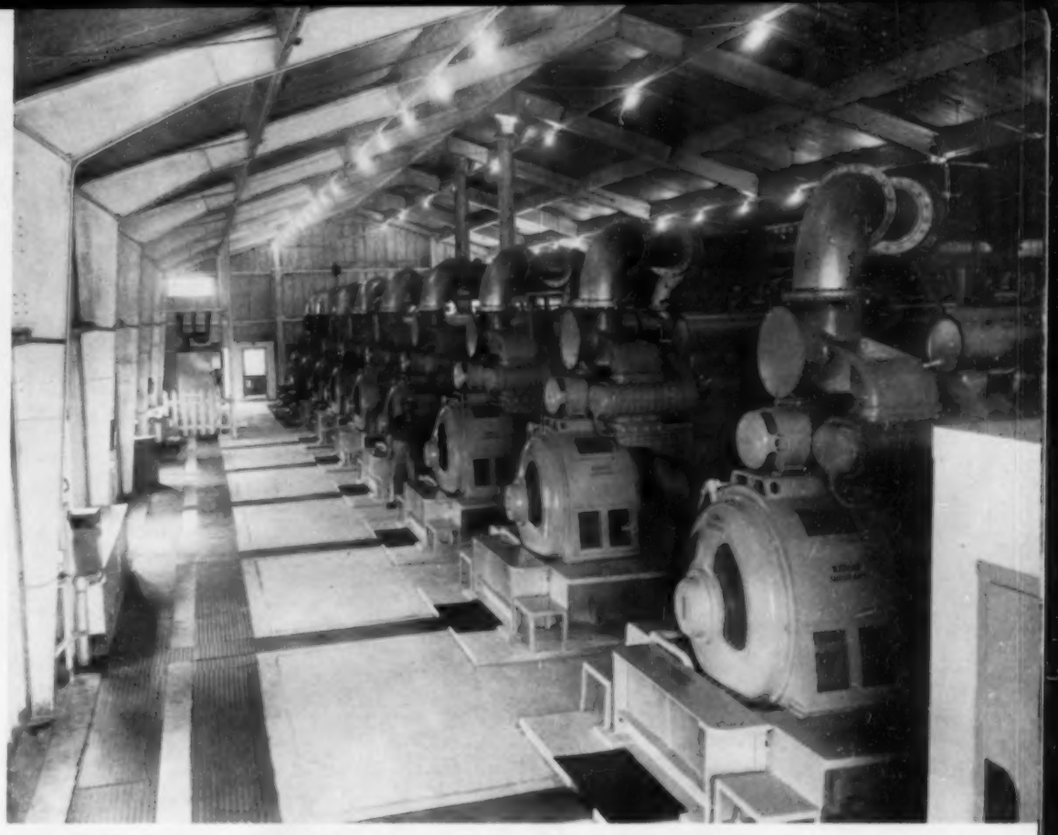
three power cars were under full load continuously until April of 1957, and have been used as standby power since then.

The three units spotted at the various adits had sufficient capacity to satisfy power needs during the early stage of the project. But to keep pace with the increasing amount of equipment being added, and with the overall growth of the work force, Perini constructed a simply designed powerhouse to house nine stationary General Motors diesel-electric sets. The structure consisted essentially of a concrete foundation and sheet metal siding, with an outdoor switchgear yard. By the end of April, 1957, the powerhouse was in operation and mobile units were put on a standby basis—ready to be cut into the line within a few minutes time. Delivering the nine units to the job site was considerably simpler than was the case for the three power cars. By then the road was greatly improved and new bridges had been constructed.

All 12 of the units installed at Chute des Passes are essentially of the same basic design—standard packaged machines available off the shelf. Output capacity of each unit is 1000 kw at .8 power factor, 4160/2400 volt, three phase service. The prime mover used is the General Motors model 16-567C diesel engine, with 120 volt electric battery starting. The ac generator is rated at 60 cycle, 2400/4160 V, 3-phase, 1250 kva, 720 rpm.

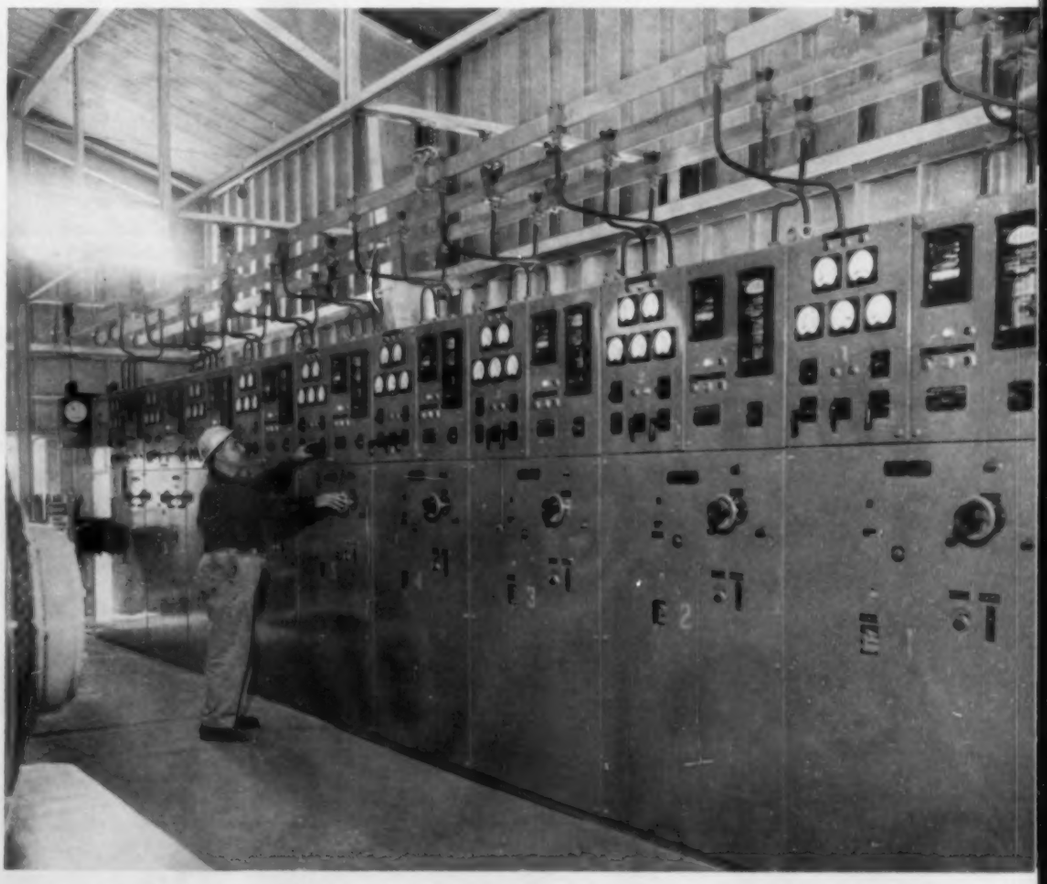
The difference between the three mobile units and the nine stationary generating machines is simply in the "packaging" of the components, the mounts used, etc. The unit at No. 1 adit is different from the other eleven in that it is fully automatic. This means it can be started and stopped remotely, is automatically synchronized with line in phase, frequency and voltage; and will start up and shut down automatically on a predetermined schedule. In case of any difficulty, such as engine overheating, or low oil pressure, all units, both mobile and stationary, will shut themselves off automatically. When the mobile units were in full operation, each machine had an operator and an assistant. The capacity of the fuel tanks is sufficient to keep the machines operating at full load for 24 hours. The cars were refilled once a day by gravity feed on a predetermined schedule. At full load, fuel consumption is approximately 66 Imperial gal./hr. Power to living quarters and to the machines is distributed by approximately 25 miles of primary cable, which is ½ in. diameter aluminum wire.

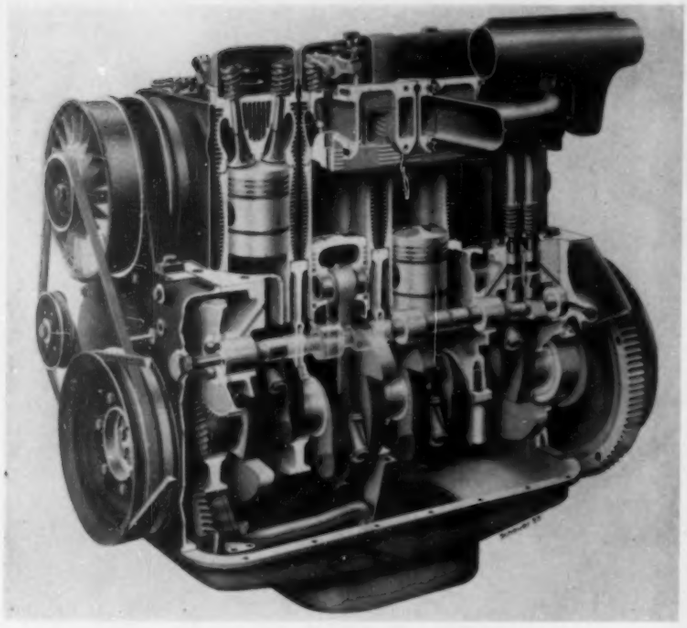
According to the contractor, the diesel-electric units, both the mobile power cars as well as the units that comprise the powerhouse, have performed outstandingly. Maintenance required is strictly routine; 72 hour and 2000 hour inspections and an oil and filter change at 1500 hours. Because of advantages gained on the project through early availability of adequate power, the machines have more than paid for the $100/kw cost and the contractor is planning to use this type of equipment on upcoming projects. J. W. Liddle is the field project head for Alcan and Del Cannon, vice president and chief engineer for Perini, Quebec, Ltd., represents the consortium. Hans Kopp is the superintendent of operations for the power equipment.



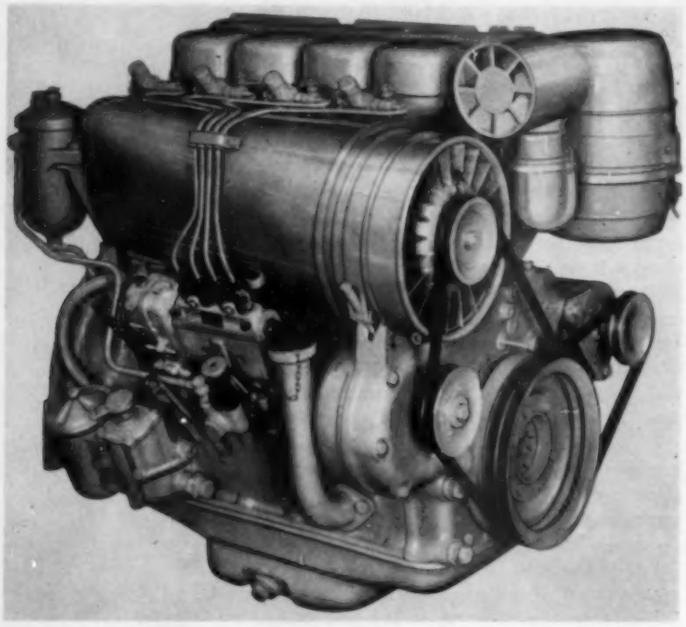
Interior of powerhouse at Chute des Passes. Despite the fact that the construction camps are hundreds of miles from the nearest town, the powerhouse serving them is as attractive as any that can be found in town. Hans Kopp, superintendent of operations who runs the 12 diesel-electric units had little trouble training local labor to operate and service the equipment.

Hans Kopp, Perini's Superintendent of Operations, at the control board in the powerhouse. Kopp reports that despite the rough journey the 12 diesel-electric power units had in getting to the site, there was little trouble in getting them to full operation.





Cutaway view of the four cylinder Deutz 712 series, air-cooled, four cycle diesel, with an intermittent rating of 60 bhp at 2800 rpm.



The new Deutz model F4L 712 air-cooled diesel. Note Robert Bosch fuel injection pump.

THREE NEW AIR-COOLED DIESELS

THREE new models of Deutz air-cooled diesel engines have been added to the existing line offered in the United States. The new engine models are the F3L 712, F4L 712 and F6L 712, representing 3, 4 and 6 cylinders, vertical in line engines, with a bore and stroke of 3¾ x 4¾ in. Like on all the other Deutz air-cooled engines, the development engineers have again used the unit cylinder construction principle. These new engine models are an extension of the small engine family of Deutz engines, whereas the larger family of air-cooled engines (bore and stroke 4⅜ x 5½ in. model 514/614) range is from 2- to V-12 cylinders. The new units can be used for off-highway vehicles, construction and farm equipment, stationary use like generator, pumping and compressor sets, marine propulsion and shipboard auxiliaries.

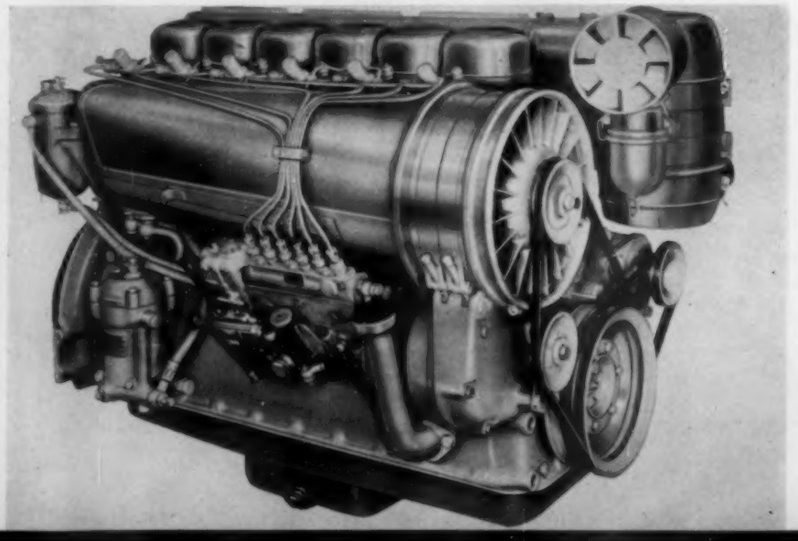
On all five 712 models, F1L 712, F2L 712, F3L 712, F4L 712 and F6L 712, the majority of wearing parts like cylinders, cylinder heads, pistons, connecting rods, valves, rocker arms, bearing inserts, etc., are all completely interchangeable between all models. By standardizing of cylinder units maximum usage of interchangeable parts is made, simplifying stockkeeping and maintenance.

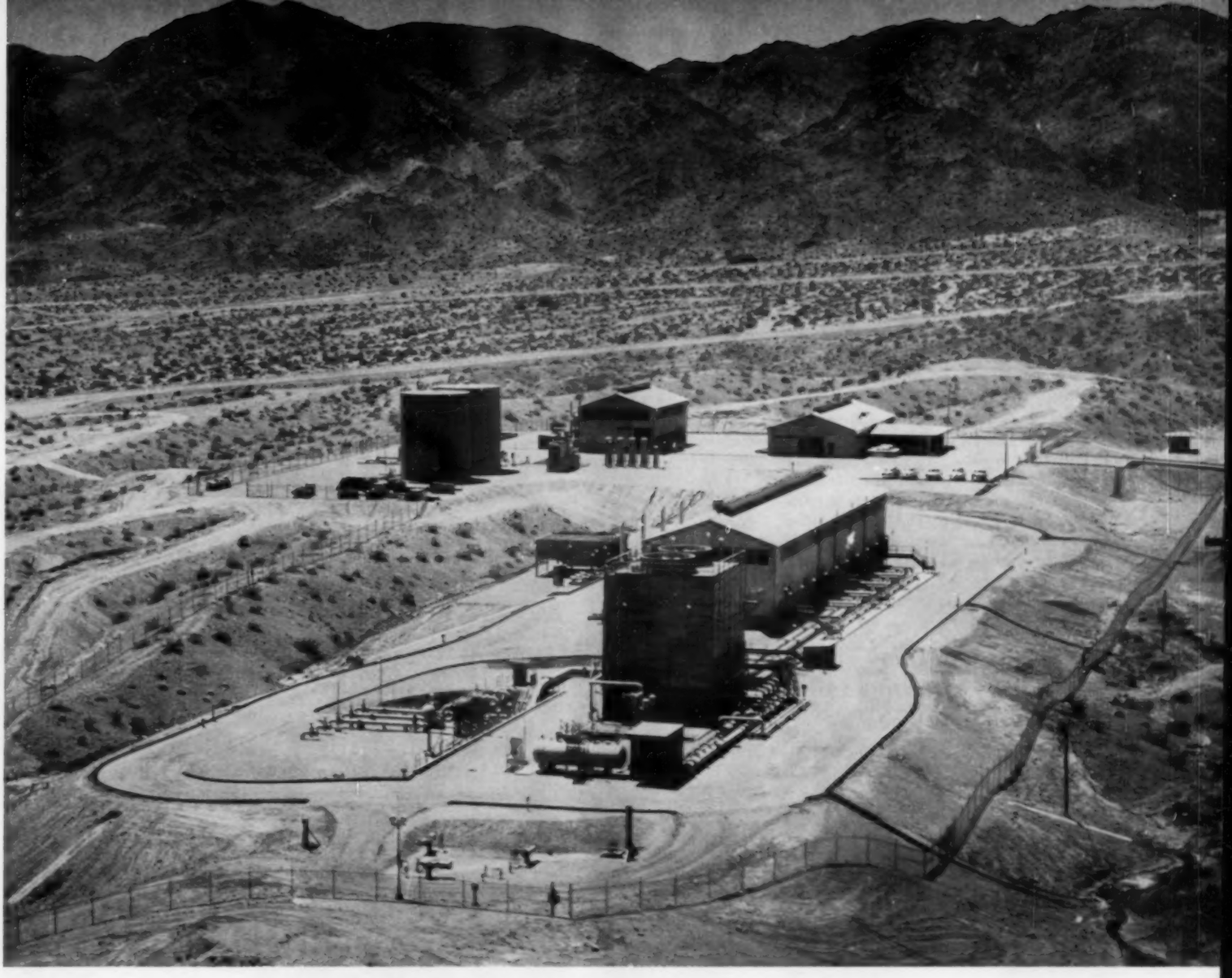
A brief technical description of the new engines is as follows: Construction; vertical in line cylinders, overhead valves. Working principle; 4 stroke cycle, compression ignition. Combustion system; Deutz L'Orange swirl chamber, with glow plugs for cold starting down to 40° below zero. Piston displacement; 52 cu in. per cylinder. Compression ratio; 17.5:1. Fuel injection system; Robert Bosch injection pump with fuel feed pump and filter. Pintle type injection nozzles. For variable speed applications injection pump drive is equipped with automatically synchronized injection advance. Governor: Robert Bosch, variable speed and/or constant speed. Cooling system; axial flow blower, V-belt driven. The industrial engines come equipped with an automatic shut down device. Lubricating oil system; forced feed to all moving parts, with full flow filter with a secondary micron filter. Lube oil cooler optional on 3-cylinder engines, on 4-cylinder engines required at speeds exceeding 2300 rpm, and on 6-cylinder engines it is always part of the lube oil system. Starting system; electrical with inertia optional. Combustion air filtering; oil bath air cleaner with cyclone type pre-cleaner. Fuel consumption; 0.407 lb/bhp-hr at full load. Flywheel and bell housing; SAE #2-3 standards.

Brief Specifications

	F3L 712	F4L 712	F6L 712
Height:	33 in.	33 in.	33 in.
Width:	25 in.	25 in.	25 in.
Length:	30 in.	35 in.	48 in.
Weight: (including all standard accessories and electrical starting equipment)	616 lbs.	693 lbs.	902 lbs.
Intermittent output at: 2800 rpm	45 bhp	60 bhp	90 bhp
Continuous 24-hour output at: 2300 rpm	33 bhp	44 bhp	66 bhp
Maximum torque lb-ft/rpm	93.5/2300	123/2300	184/2300

The six cylinder model F6L 712 diesel, which develops an intermittent output of 90 bhp at 2800 rpm, with a maximum torque of 184 ft/lb developed at 2300 rpm.





Aerial view of Needles compressor station showing gas metering and scrubbing facilities, left foreground; gas cooling tower and acid facilities, right foreground; compressor building, center; warehouse, shop and administration building, background right; generator building in left background; and on extreme left, background, water storage tanks.

NEEDLES, CALIFORNIA

Gas-Driven Engine Compressors Power $3.5 Million Needles, Calif. Compressor Station

By JAMES JOSEPH

SOUTHERN California and Southern Counties Gas Companies' new, $3.5 million Needles compressor station sprawls across 60 deep-desert acres a few miles west of the Arizona-California border. As primemover along 285-miles of newly laid 30-inch pipeline, the station monitors this, the third major natural gas artery from Mid-continent, upping Southern California's total gas supply above the one billion cubic feet a day mark. Moreover, the Needles (Calif.) station is a gas power saga—all the way. Natural gas powers the station's four 2000 hp Clark compressors, first of seven to be installed by 1960. Natural gas fuels the facility's two 577 hp Worthington generator sets—backboning the plant's electrical self-sufficiency. Natural gas powers one of two air-start compressors—suppling plant air. Natural gas—in the absence of electricity—will keep operative station's fire pumps, whose engines are gas-driven.

Heart of the station is its compressor building, a structure housing the four 2-cycle, gas-engine-driven 2000 hp Clark TLA-6 compressors, each turbocharged. With a bore of 17-in., a stroke of 19-in., each TLA incorporates four horizontal compressor cylinders. Already installed is the bed for a fifth compressor, due to become operative in

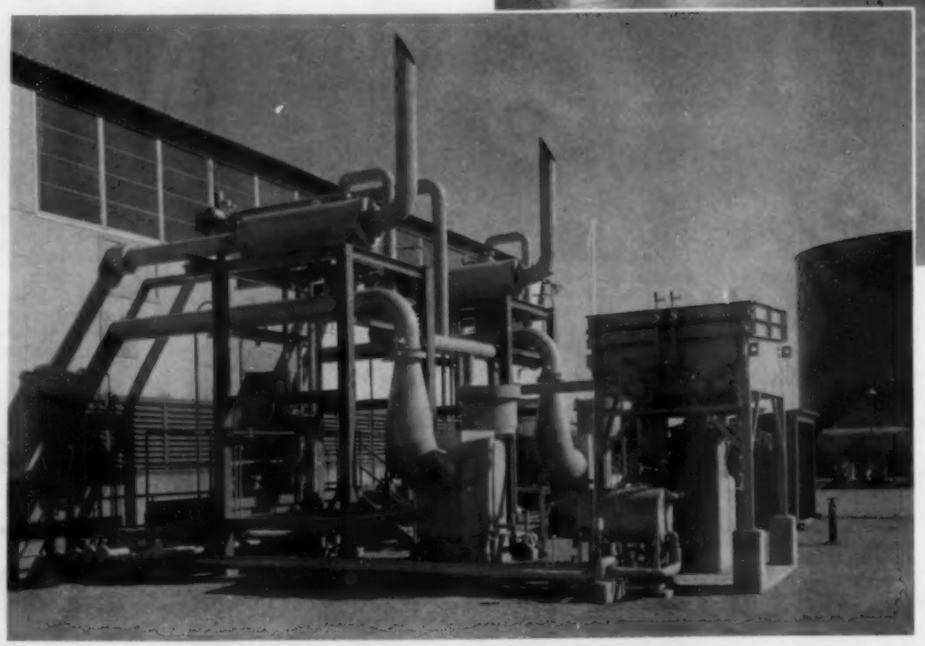
late 1958. When all seven are installed—for a total 14,000 hp—the station's gas capacity will reach 328.8 million cubic feet a day with 78.1 million cu ft of usable line storage. With an intake suction pressure of 450-500 psi, the plant compresses mid-continent gas (delivered from El Paso Natural Gas Co.'s Topock, Arizona, metering station), discharges it at a maximum 936 psi— and routes it along the 30-in. line to Newhall, Calif., 241-miles west of Needles.

Plant fuel gas (some 1400 cu ft/hr per compressor) is tapped, immediately after scrubbing, by two standard orifice meters. One, a 4-inch orifice meter, fuels the Clark compressors. The other, a 2-in. orifice, supplies the Worthington generator sets. Further, even should the plant be shutdown, the station's fire pumps and electrical generators would remain operative—fueled by two taps off the main line (a ½-in. tap supplying gas-driven fire pumps, a 1-incher fueling the generators' drive engines). A single jacket-water surge tank (outside the compressor building) serves the four engine-driven compressors. Currently, two pumps power the jacket water cooling circuit. These are 6x6x12 single stage end-suction units, delivering 1200 gpm of 150-degree water against a total head of 55-ft. They're driven by 25 hp motors. Jacket water leaving the engines at 175-degrees F. flows to the surge tank (4x25-ft and rated 100 psi), then is pumped to a two-fan Griscom-Russell horizontal fin-fan cooler, one of its 12-ft dia., 4-bladed Hartzell fans pitch-adjustable (and driven by a 30 hp motor thru spiral bevel gears). Tower's designed to cool adequately (during full load) at 120-degree ambient temperature.

Compressor lube oil cooling—in a closed system—utilizes the same induced draft cooling tower which cools compressed line gas. Involved is a double-loop of 10-in. dia. piping running outside the compressor building, and monitored by three 4x5x10 single stage end-suction pumps delivering 610 gpm of 120-degree water against an 85-ft head (pumps are driven by 20 hp motors). Each compressor's shell-and-tube lube oil cooler (Clark) is installed across this closed double line. Lube oil leaving the engines at 155-165 degrees F. drops about 10 degrees across the heat exchangers. Prime reason for utilizing the greater capacity of the tower (when compared to the jacket water fin-fan cooler) is the larger volume of coolant water available—and required—for lube-oil cooling. The shell side of exchangers carry the water; the tube side, lube oil. The same system furnishes water to the after-coolers of each compressor's turbocharger.

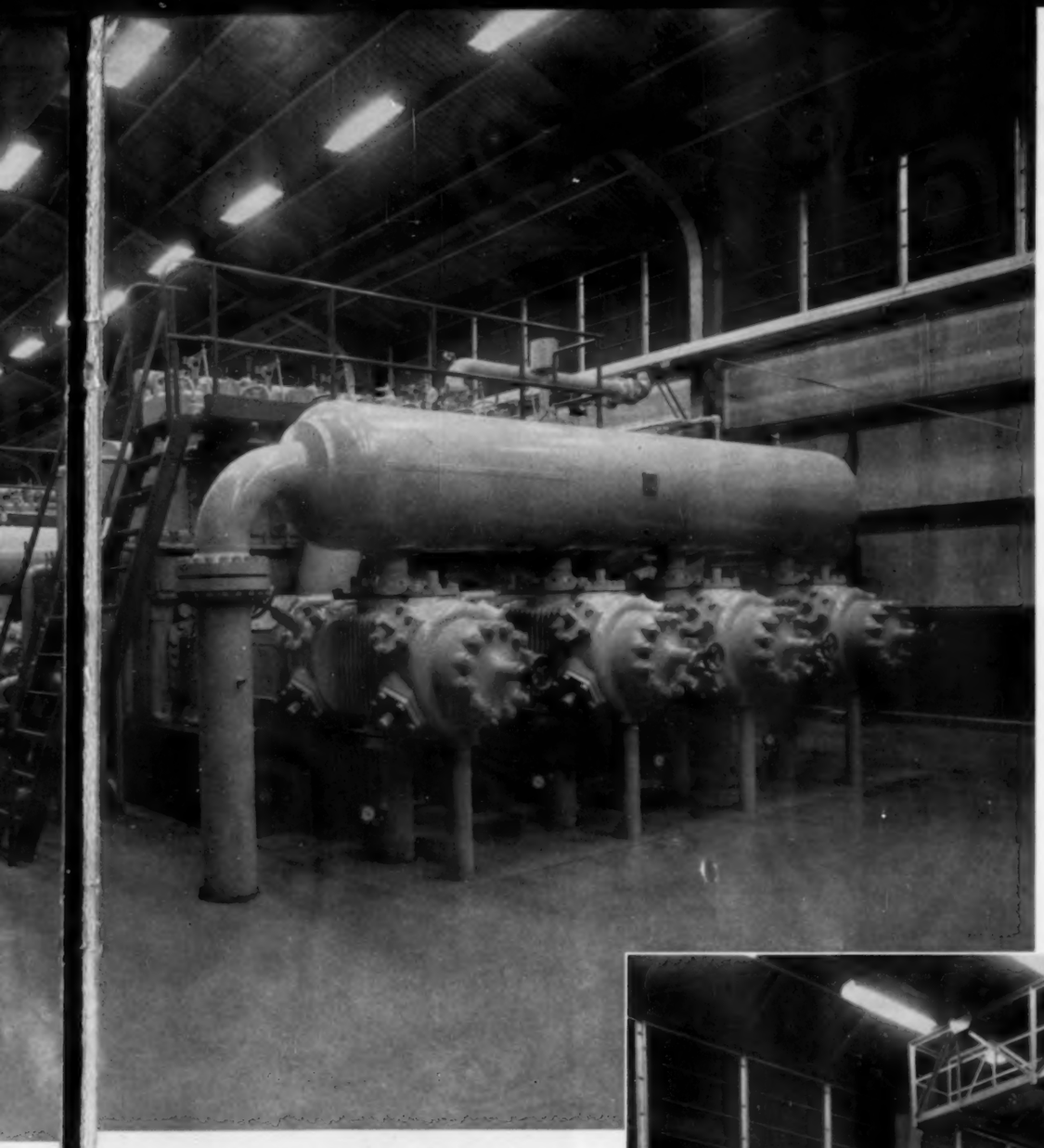
Compressor engines, installed with American Bosch pulse ignition generators and McCord lubricators, are equipped with 18-in. Maxim exhaust silencers, American oil-bath intake air filters and each mounts its own control panel. Additionally, the compressor building's big, all-station monitor panel, incorporating an annunciator system, automatically warns of trouble in any of the plant's major systems and components (the warning, via an air horn, can—says area superintendent M. R. Tanner—"be heard for a mile"). The site is further protected from a danger endemic to the Mojave desert—flash floods. Though the Needles station stands on a kind of mesa (altitude: 1400-ft), engineers constructed a triangular, prow-like, 6-ft high revetment around the site's uphill end. The dike—its two legs each 1500-ft long—comes to a point at the station's west end. The dike is massive, measuring some 8-ft across its top, 22-ft at the base, its sides steeply inclined (slope ratio: 1¾:1). 150-ft of facing concrete bulwarks the dike's point. Additionally, its outward slopes are faced with 3 in. of blacktop, reinforced internally with #11 gauge black chain-link fence fabric, 10-ft wide. The dike is further buttressed by a rubble footing (some 4-ft wide, 2-ft high) which runs its length. The footing is actually below desert level.

Station water (some 100 gpm during the Mojave's sizzling summers) is pumped 10½ miles thru an 8-in. concrete-lined pipe (with an elevation head of 100-ft)—the source, two wells in the vicinity of Needles, Calif. Electrical self-sufficiency is backboned by two SCCG-6, Worthington 4-cycle (577 hp at 514 rpm) turbocharged natural-gas fueled engines, with a bore of 10.75 in., a stroke of 14.5 in. They drive General Electric 500 kva generators and exciters (400 kw, 440-volts, 3-phase). In the same generator building are two Ingersoll-Rand compressors—which furnish plant starting and utility air. One engine-compressor combine is an Ingersoll-Rand 2-stage air compressor delivering 169 cfm of free air at 250 psig, and driven by a 50 hp electric motor. The other—an Ingersoll-Rand is a two stage, air-cooled compressor delivering 113 cfm at 250 psig, driven by a Wisconsin engine, which has been adopted to burn 1000 btu per cu ft fuel gas. Compressors supply: (1) instrument and utility air; (2) starting air; (3) emergency shutdown air.



Exterior of generator building, showing Maxim silencers; Vapor Phase unit; Air Maze air intake filters.

The Vapor Phase system cools the two Worthington gas engine-generators at 250°F thereby recovering the heat being rejected to the water jackets as steam at 15 psig pressure. Both systems are connected by a steam header that supplies steam, through a pressure reducing valve, at 5 psig to Servel water chilling type machines for air conditioning the offices. As these machines do not require all of the steam the Vapor Phase system includes an engine cooler equipped with a low pressure steam turbine connected to a cooling air fan. Up stream in the turbine inlet line a pressure regulating valve holds a pressure of 15 pounds so as to force the required steam to the air conditioning units. When there is an excess of steam this valve opens passing it to the turbine causing it to



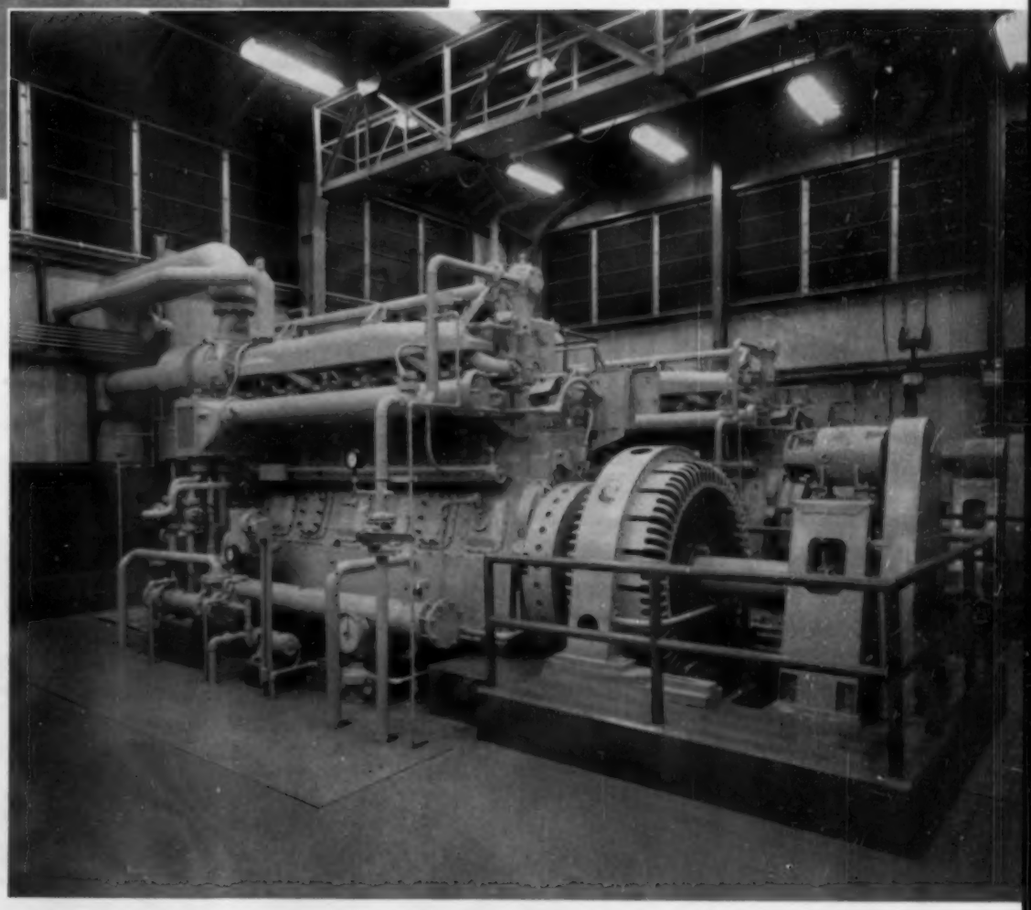
Compressor side of the main compressor building. Each of the four Clark Model TLA-6 compressors have four horizontal cylinders. Engine equipment includes Hilco lube filters, Massey governors, and American Bosch pulse ignition.

start automatically and to stop when the pressure in the header drops. All excess steam is condensed in the engine cooler and the condensate from this and the Servel units is collected in the hot well shown on the drawing where it is pumped back to the engine water circuit making it a completely closed engine cooling system.

With the Needles station on the line, Southern California will draw 75 per cent of its natural gas from Mid-continent sources. Says a gas company spokesman, "annual increments have averaged 100 million cu ft a day since gas was first brought into Southern California 10 years ago. With the area's continued growth, we must assume that annual additional increments will be required at the same rate for a number of years in the future." It is that ever-expanding future which Needles compressor station—eventually to house seven compressors—aims to insure. Designed by M. A. Nishkian & Company, consulting engineers, the new compressor station was built by Peter Kiewit Sons. M. R. Tanner is area superintendent. Plant foreman: J. F. Dixon.

Equipment List

Engine-driven compressors	Clark
Turbocharger	Clark
Governors	Massey
Lubricators	McCord
Air intake filters	American Air
Exhaust pyrometer	Alnor
Exhaust muffler	Maxim
Jacket water pump	Peerless
Pulse ignition	American Bosch
Jacket water coolers	Griscom-Russell
Lube oil filter	Hilco
Strainer	Cuno
Electric generating units	Worthington
Generators	General Electric
Vapor phase system	Engineering Controls
Exhaust silencers	Maxim
Air intake filters	Air Maze
Governors	Woodward
Lube oil filters	Cuno
Lube oil cooler	Sims



Natural gas fuels the facility's two 577 hp Worthington generator sets—backboning the plant's electrical self-sufficiency. The SCCG-6, 4-cycle turbocharged engines drive General Electric 500 kva generators and exciters.

DIESEL-ELECTRIC SETS ON PFE REEFERS USE NEW BRUSHLESS GENERATORS

PACIFIC Fruit Express, a subsidiary of the Southern Pacific and Union Pacific Railway systems, is the largest refrigerator car line engaged in transport of perishable commodities under wide extremes of ambient temperatures. This involves cars and facilities to handle a wide range of temperature and ventilation requirements; also to provide heat where necessary. Lemon shipment for example, uses about 55 degrees F., oranges 35-40, beef 32-33; frozen foods on the other hand need a temperature of near zero. These perishables must be carried from source to market with a maximum of reliability, minimum of attention and with economy. To achieve this the engineering staff of Pacific Fruit Express has pioneered many developments and innovations in design and operation of refrigerator cars. One of the most recent of these is the mechanical reefer.

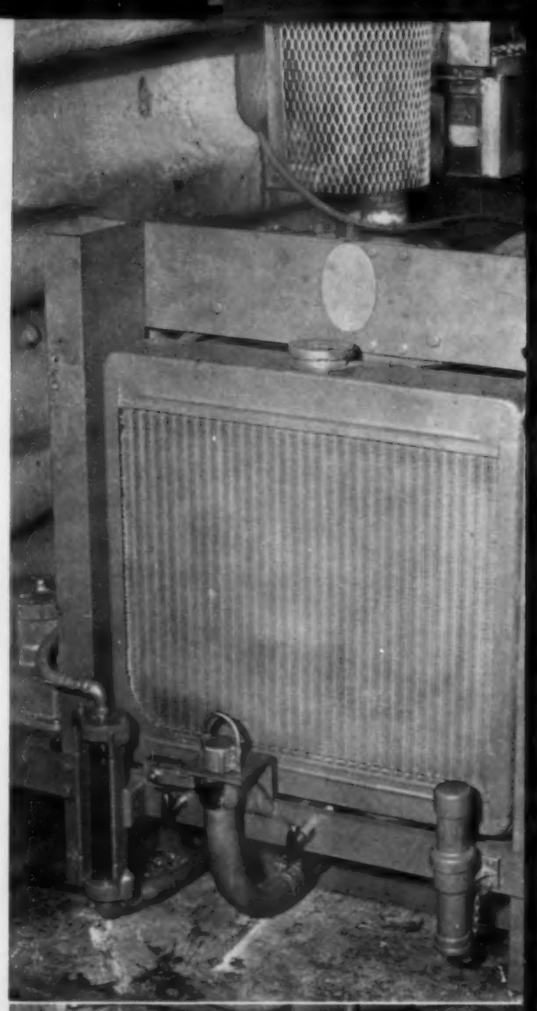
Ever since the dawn of refrigerated transport service, ice has provided the means of cooling. Icing is still by far the most widely used method for the general run of perishable products transported by rail and PFE has vast facilities for this, installed over the years to speed the products of the Pacific Coast, fresh and healthful to all parts of the United States. However with the advent of quick frozen foods the important superiorities of mechanically refrigerated cars and the new advantages they provide shippers resulted in the early investigation and rapid development of the mechanical reefer by PFE engineers. The swift and amazing result, within a few years, has been the installation of a growing fleet of modern refrigerator cars equipped for mechanical refrigeration to complement PFE's system of iced cars.

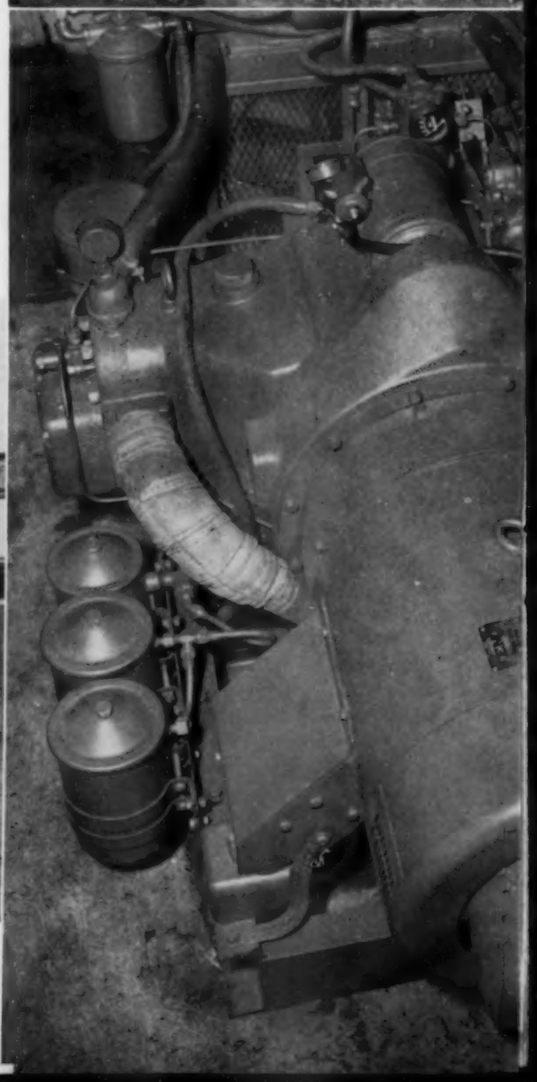
Growing use of mechanical reefers centers around the importance of complete climate control of perishable cargoes and the adaptability to a wide range of varying demands. The advantages provided, as listed below, make practicable the substantially higher first cost and greater complexity of the mechanized car:

1—Ability to create and hold the desired conditions of temperature and humidity within a narrow temperature band.
2—Uniformity of temperature through a densely packed load.
3—Ability to adapt to changing weather en route.
4—Ability to hold colder temperatures.
5—Elimination of corrosion damage to rails, bridges and equipment from brine.

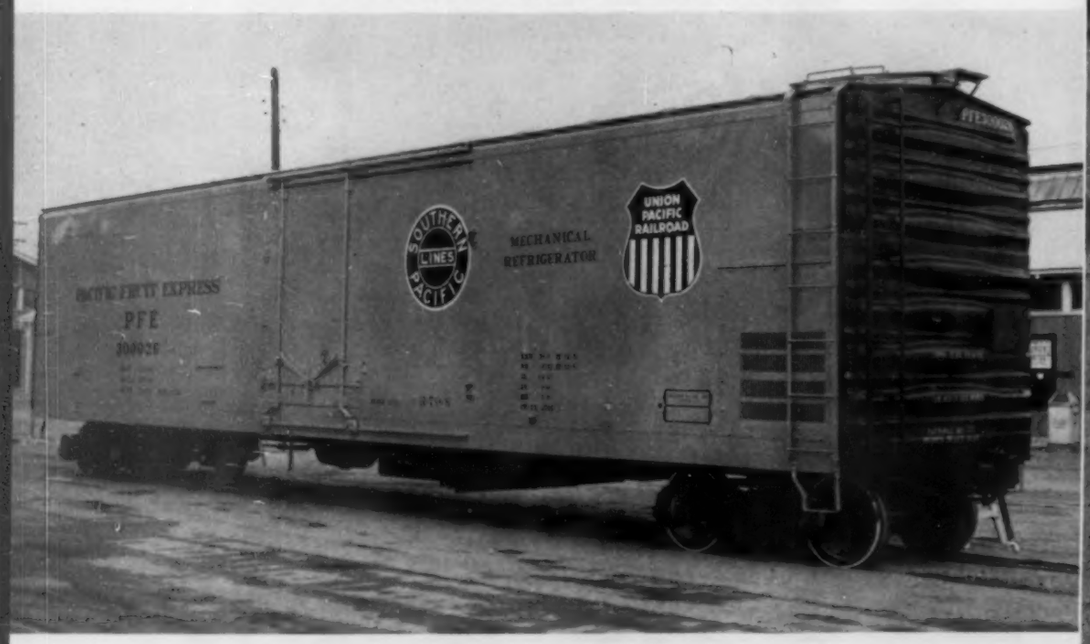
Components of Pacific Fruit Express Company's newest mechanical reefers are shown in the illustrations to the right. The refrigerating plant is located in a compartment at one end, separated from the load space by an insulating wall. There are louvered openings in the compartment side walls for air circulation around the mechanical equipment. The heavily insulated car for frozen food transport uses an envelope construction, with chilled air circulating through a shell about 1½ in. deep which surrounds the entire cargo, in walls, ceiling and floor. While chilled air surrounds the load it never actually touches the cargo. In the case of fresh produce, chilled air is circulated around the produce to provide temperature and humidity control.

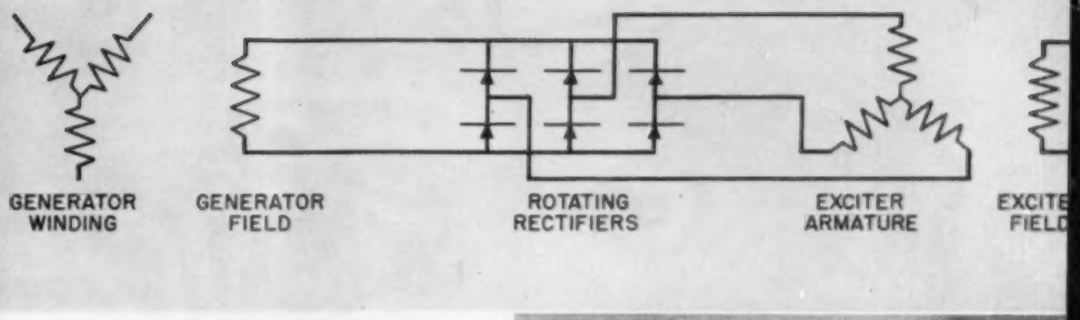
The refrigeration system consists of the following





Pacific Fruit Express car equipped for mechanical refrigeration.

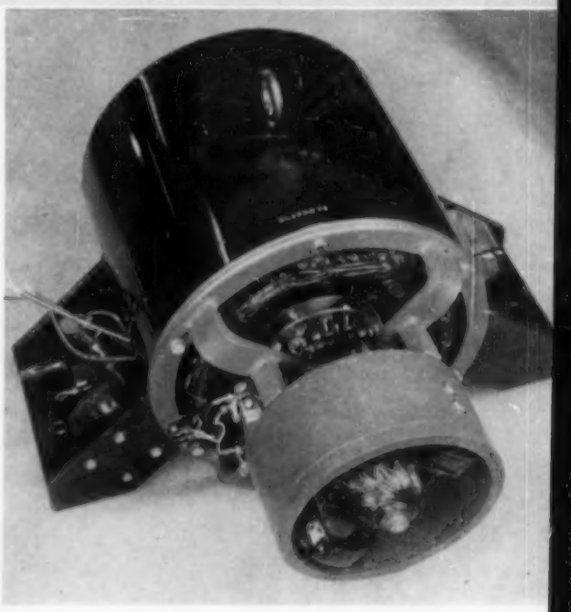




Electrical Schematic of the brushless generator.

Silicon rectifiers, mounted on the shaft, and connected directly between the exciter armature winding and generator field as shown to right eliminate commutator, collector rings and brushes.

Picture shows power plant and compressor components installed in a compartment at one end of the PFE mechanical reefer. Note Vortox air cleaner.



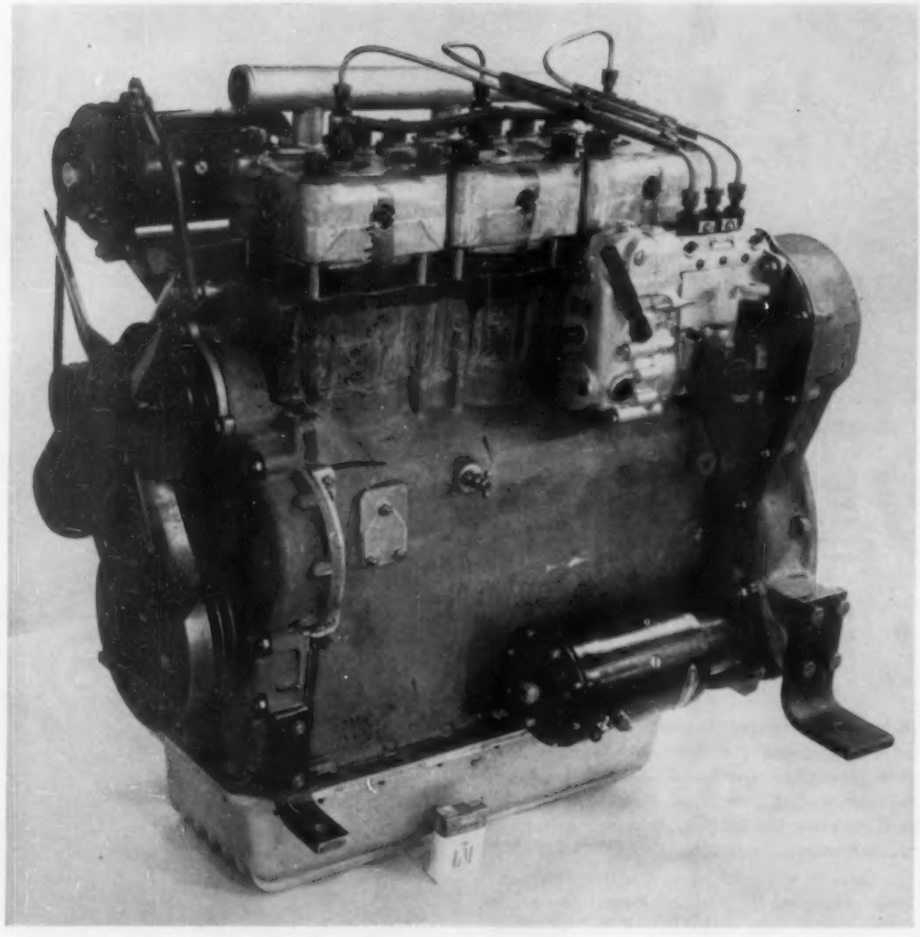
major units: the power plant consisting of the diesel engine and ac generator; motor-compressor unit; condenser-radiator and fan assembly; evaporator or cooling unit; chilled air blower; automatic control for starting, stopping, defrosting, etc. and protective devices.

Power plant for the PFE mechanical reefer is a self-contained unit manufactured by the Witte Engine Works, Oil Well Supply Division, United States Steel Corporation, Kansas City, Missouri. It consists of a diesel engine, alternating current generator, a battery charging generator mounted on the engine, and the associated protective devices. Electric power provided by the plant drives the motor-operated compressor and evaporator and condenser blower motors. In addition, electric power is supplied to the heater elements for adapting to extremely low ambients, defrosting the evaporator coil and for the drain pan heater.

The vital importance of continuous, dependable operation over long periods of time with a minimum of attention and maintenance has focused attention to the elements of design and construction in the power plant that will insure sturdiness and reliability under the vibrations and shocks of continuous railroad service. The engine is especially designed for this transport service. It has the capacity and lubrication system to develop 18 continuous horsepower for continuous 24-hour a day service. The engine is an 1800 rpm, two-cyl., four-cycle, horizontally-opposed type which minimizes vibration. It has massive construction and a low center of gravity silhouette, resistant to shock. The 12.5 kw, 1800 rpm, 0.8 power factor, 3-phase, 60 cycle, 225 volt generator is heavy-duty, single bearing, revolving field, brushless type directly connected to the engine. The generator exciter is direct mounted on the end of the generator shaft. All-steel construction of the generator provides high resistance to vibration and shock: generator field windings are wound directly on the rotor poles; the windings are bonded in thermo-setting resin; all leads are short and securely anchored; shaft, bearings and bolts are over-size. The generator fully meets NEMA specifications.

Two features of the generator are of special interest. It is an inherently self-regulating type and has a built-in booster circuit which insures an ample voltage for starting the compressor motor. All brushes, commutators, and collector rings are eliminated, giving the utmost simplicity of operation, and practically complete freedom from maintenance. The brushless generator has been made possible by the availability of dependable, small size, silicon power rectifiers. Instead of the usual commutator and collector ring method of getting excitation to the generator field, the output of the exciter is fed directly through the rectifiers mounted on the generator shaft to the field winding of the generator. A small portion of the generator output is rectified to automatically provide excitation and voltage control to the field of the exciter. Thus, the diesel-electric power plant has many built-in features of simplicity and strength to assure maximum, dependable performance.

Witte model 100RDA diesel-electric set is powered by a 2-cyl., 4-stroke cycle, horizontally-opposed diesel engine. The low silhouette and heavy duty construction are especially suited for continuous-duty railway service. Engine develops 18 hp at 1800 rpm to drive the 12.5 kw ac generator.



Three cylinder model 3 Cerlist diesel rated 65-85 hp, 2600-3000 rpm.

INTRODUCE HIGH SPEED LOOP SCAVENGED DIESEL

CERLIST Diesel, Inc., Burlington, North Carolina has introduced a new series of two cycle, loop scavenged high speed diesels. These engines have a number of unique features and have been designed by Dr. Hans List. The Cerlist model 3 is the first of a line of five models ranging from 55 to 225 maximum bhp. It is rated 65 hp @ 2600 rpm for continuous duty; 75 hp @ 3000 rpm for intermittent duty and 85 hp @ 3000 rpm for automotive duty. This engine line has been designed with a 4 in. bore and 4½ in. stroke to provide a high factor of design safety.

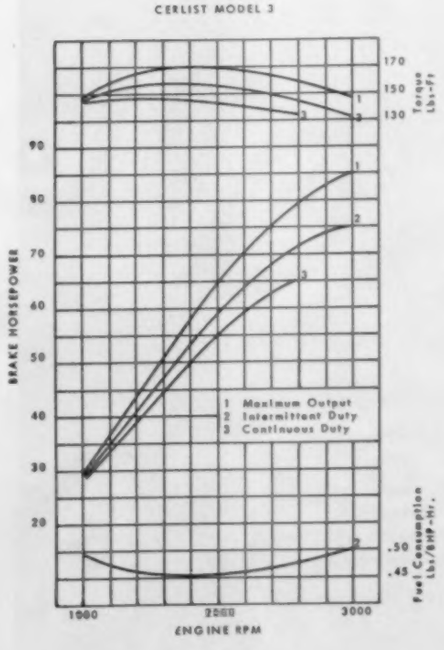
The model 3 features high output in that it has a low weight to power ratio and a high output per unit of swept volume. Based on the continuous rating of 65 hp, a weight of 605 lbs fan-to-flywheel, and a displacement of 170 cu in., the engine weighs 9.3 lbs per continuous horsepower and produces .382 continuous horsepower per cu in. displacement. Cerlist engines are designed for automotive applications and for portable equipment such as construction machinery, pumps, power and welding generators, sawmills, small locomotives, well drilling rigs, crushing and screening plants, track or wheel tractors and marine power. These engines are well suited for use with torque converters.

There are two general methods for increasing the power output of a diesel engine. The first is to increase the number of power strokes per unit of time and the second is to increase the output per power stroke. The design of Cerlist model 3 accomplishes the first by utilizing the 2-stroke cycle loop—scavenged principle and raising the crankshaft speed. At the continuous designed speed rating these engines deliver 2600 power strokes per minute per cylinder. However, since the effective power stroke of a 2 cycle engine terminates at about the time the piston uncovers the exhaust ports not all of this apparent gain can be utilized. In the Cerlist engine 65% of the stroke is effective as a power stroke.

High crankshaft speed of the engines has been made commercially feasible by several design features. The problem of adequate and controlled distribution of lubricating oil over the entire area of the wet cylinder liner which is swept by the piston rings has been solved by a combination of piston and piston ring design together with design and surface finish of the liner. These factors provide uniform contact between the piston rings and the cylinder wall. The latter is slightly barrel-shaped at the port area to relieve the higher ring bearing pressures in this area and prevent scuffing. Since the effective sealing of the oil rings occurs in areas which are exposed to only slight wear the oil consumption does not, in general, increase with continued running hours. The cylinder liners are bonderized to provide high oil retention characteristics during break-in.

A second feature related to increased crankshaft speeds in the design is the placement and shape of the inlet and exhaust ports in order to maintain high scavenging efficiency during the shorter time interval available for this process. The result is demonstrated in the engines where high output is combined with simplicity of design and rugged construction.

A major contribution toward the low weight to power ratio is made by the extensive use of aluminum alloys. The aluminum block is internally ribbed to carry stresses from the individual cylinder heads downward into the main bearing area. The appreciable depth of the block below crankshaft center provides rigidity to prevent warpage and distortion. The aluminum cylinder heads are simple in design since all valves and their related gear have been eliminated. These heads have a high resistance to thermal stresses and are well



Performance curves at standard conditions (29.92" Hg, 60° F) showing net brake horsepower, torque and fuel consumption with all accessories including fan mounted and driven.

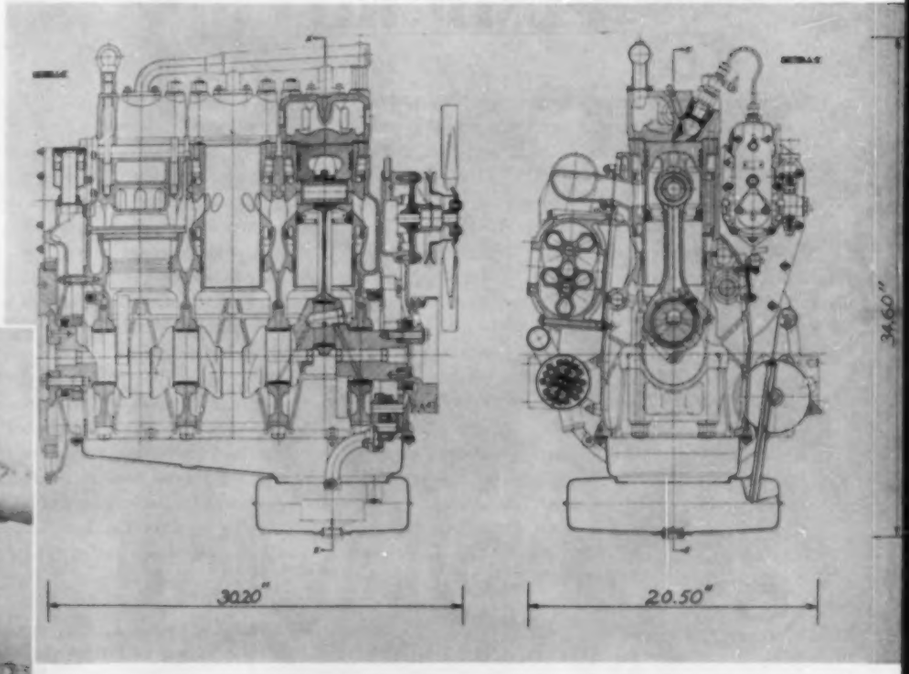
suited to the higher supercharging which is planned for the V-4, V-6, and V-8 engines in the series. The aluminum piston carries four compression rings and two oil rings. It has a flat crown to provide maximum strength and at the same time permits a close approach to the head to achieve the high compression ratio of 22:1. The piston is cooled from below by a spray of oil which is forced through a drilled passage in the forged connecting rod.

The wet cylinder liner is a heavy duty ferrous casting with six inlet and three exhaust ports. Water passages are provided between the ports and through the top flange. Four O-rings are used on each liner to seal the water spaces from the air inlet and exhaust passages, and from the crank case. The crankshaft is a nodular iron casting which offers high resistance to torsional vibration due to the high dampening factor plus high resistance to shock of this material. Four main bearings, 3.5 in. diameter, are used with deep aluminum alloy bearing caps held securely by heat treated tension bolts with a relieved center section. The rod bearings are 2.87 in. diameter and are supported by forged steel bearing caps with toothed surface to mate with similar surfaces in the forged rod body. Heat treated connecting rod tension bolts with similarly relieved center sections are employed. The rod caps are joined at an angle to reduce the big end width and permit the piston and rod assembly to be drawn out through the top of the cylinder. The bronze rod bushings for the heavy steel wrist pin are grooved to permit substantial oil flow for lubrication of the pin. A slot in the center of these bushings permits passage of oil for cooling piston through spray orifice in the top of the rod.

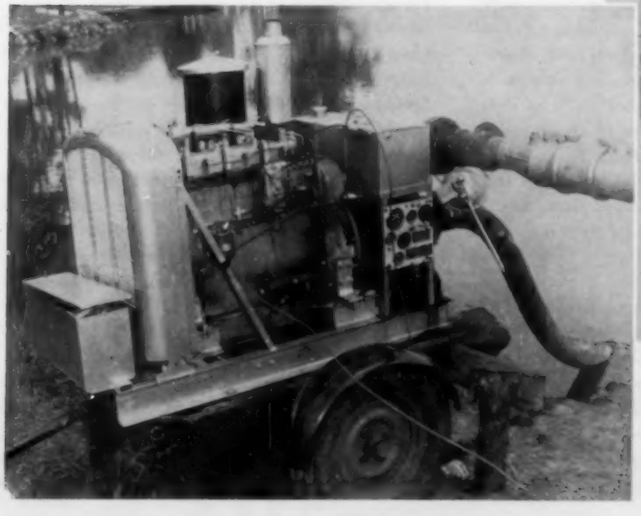
Industrial and automotive type oil pans of cast aluminum are available. The front cover is of cast aluminum and contains a cored passage for water flow to the water pump housing, half of which is cast into this cover. The outer half of the water pump housing with the shaft and impeller mount on the front cover. The cooling fan is co-axial with the water pump and driven by a V-belt from a groove in the pulley on the Roots blower. A pocket in the front cover contains the counter weight on the balance shaft which is gear driven from the flywheel end and which offsets the inertia forces to provide relatively vibration-free operation. The flywheel housing is also of cast aluminum and secured to the block through a steel plate which supports the Robert Bosch fuel injection pump. The positive gear type lube oil pump is gear driven from the front of the crankshaft. There are no external oil lines. Cored passages are provided to a bracket for the full flow oil filter. Provisions have been made on this bracket for flange mounting a tubular oil cooler.

The Roots blower is driven by two V-belts from the crankshaft pulley. This blower provides adequate air for combustion, and the excess air delivered assists in producing a good scavenging efficiency which, although not as high as the uniflow scavenging system, has the advantage of being achieved without the use of valves. A secondary effect from the excess air supplied for scavenging is the lowering of exhaust gas temperatures. This feature is attractive for marine applications. The high compression ratio of 22:1 provides easy starting and, because of reduced ignition lag, promotes quiet running. The stainless steel pre-combustion chambers makes the engine relatively insensitive to variations in the grade of fuel. A high degree of turbulence is produced in the combustion space as the initial burning of the charge expells it from the precombustion chamber orifices. The electrical system operates on 12 volts and consists of a high torque starting motor, generator and glow plugs to provide for fast starting in cold weather.

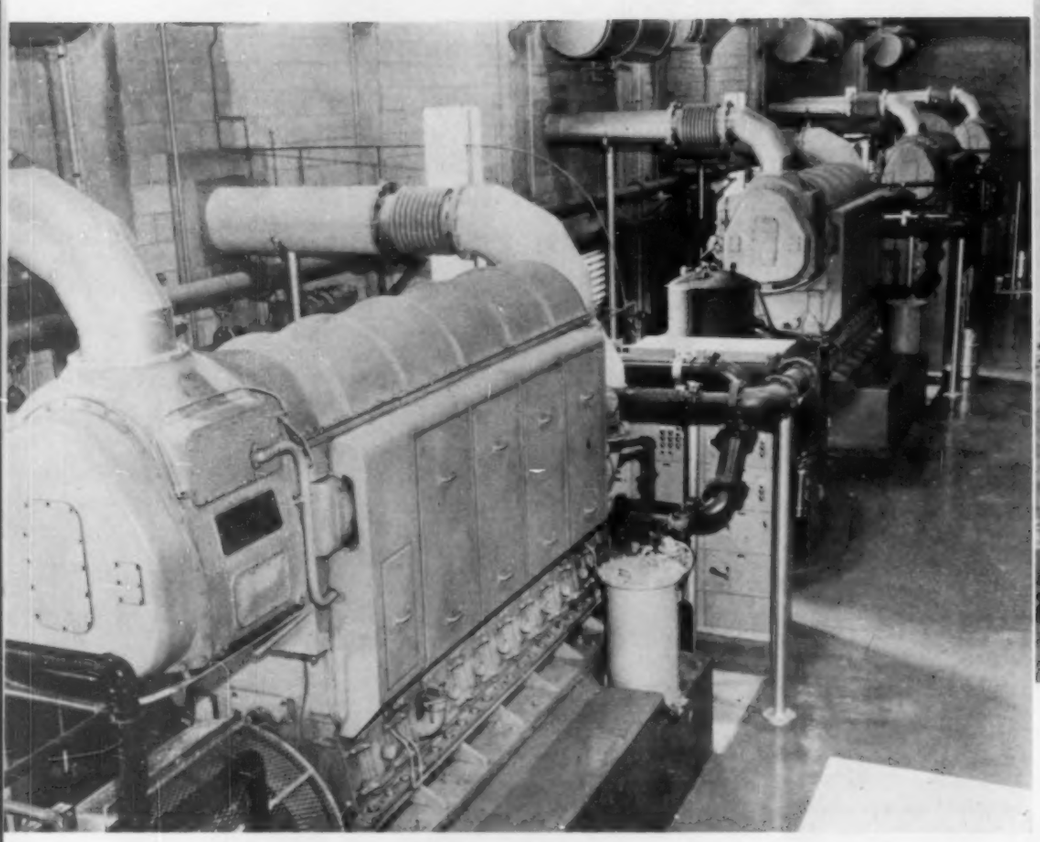
Cylinder component parts which are interchangeable between all five models in the Cerlist series.



Lateral and transverse cross sections of Cerlist model 3.



This pumping unit, powered by a model 3 Cerlist engine, is operated at 2600 rpm and delivers approx. 750 gpm with 100 psi at the pump.



Each of the four huge Fairbanks-Morse vertical axial flow pumps in Station 2 is driven by an 8 cylinder model 38D8-⅛ opposed-piston diesel engine rated at 1160 hp at 625 rpm.

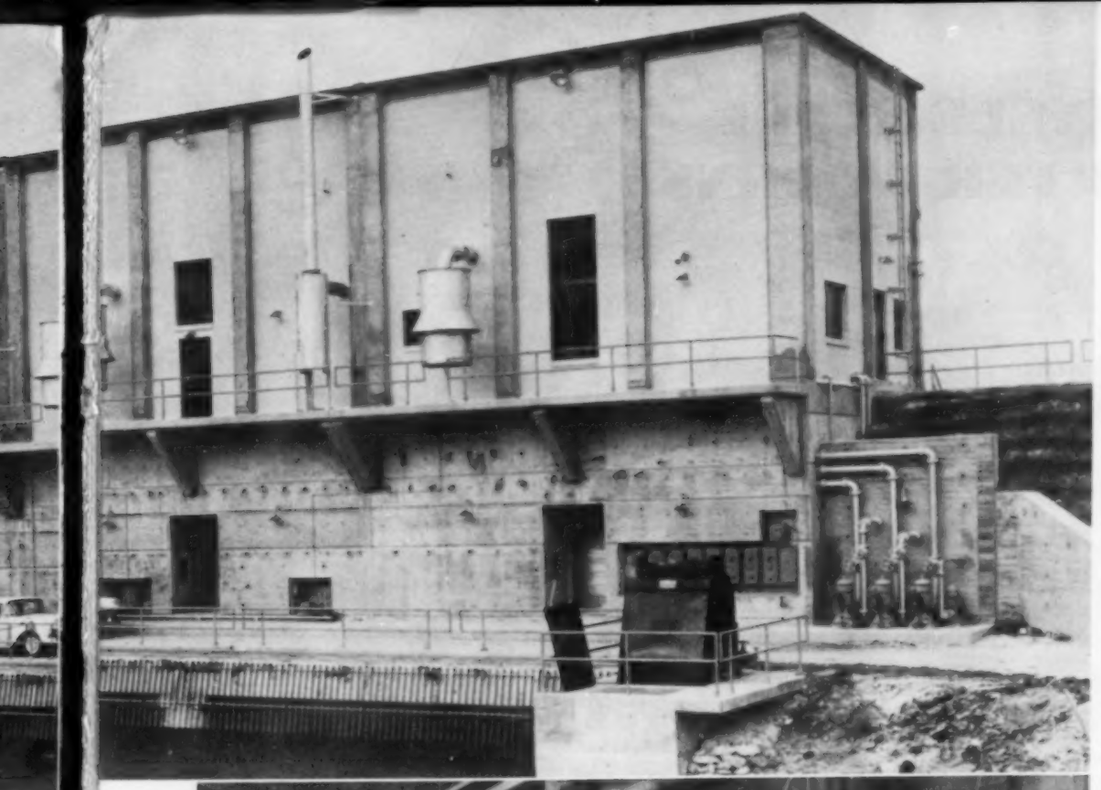
FLORIDA FLOOD CONTROL STATIONS PUMP BILLIONS, SAVE MILLIONS

SOME of the world's largest pumping stations have lifted flood after flood from Florida farm lands and saved millions of dollars in crops. From January 1957 through March 1958, thirteen Fairbanks-Morse diesel-driven pumps moved more than 285 billion gals. of water. According to unofficial estimates, the savings achieved by the Central & Southern Florida Flood Control District's pumps exceeded $44,000,000, far more than the cost of the stations. These pumping units are part of a gigantic system of canals, levees and conservation areas designed to control at last the raging waters that for centuries have brought death and destruction to Florida farms and cities. Planned and designed by the Jacksonville District, Corps of Engineers and financed jointly by Federal and State governments, the system controls water level in the canals and in Lake Okeechobee and stores excess rain water either in the Lake or in the 1500-square-mile conservation areas for use in irrigating farm land during the dry months.

For two successive winters, Florida has been deluged by near-record rains. On Jan. 21, 1957, the Everglades Agricultural Area was inundated by a tremendous 21 in. downpour. The new pumping station S-2 on the Lake Okeechobee levee near Belle Glade was preparing for her acceptance tests. With four Fairbanks-Morse vertical axial-flow pumps, each rated at 900 cfs at a head of 7.2 ft., this is believed to be the largest self-powered low-head vertical pumping station in the world. The new station was really tested. At 8 a.m. the station gauge showed 8.5 in. of rain since the night before. One three-section celery farm 15 miles from the station reported crops under 18 in. of water. The four F-M opposed-piston diesels at S-2 were started up and by 1 p.m. the celery farm was dry. Before it was through, the new station had pumped more than 8.4 billion gal. of water. For Station 5A (See Diesel Progress, May 1955) this was not a new experience. With six 800 cfs horizontal pumps, it had been called on in September 1956 to deal with a flash storm that threatened to drown cattle in the Big Mound area on the Palm Beach canal. On one farm, water was up to the cows' knees and rising fast. At 3:30 p.m. four pumps were started and water was down out of danger by 6 p.m.

The January baptism was only the beginning for the pumps at Station 2. After modest pumping in February, March and July, the station recorded 382 unit-hr. of operation in August, moving 10.8 billion gals. The next month dwarfed these figures with 841 unit-hr. and 23.8 billion gals. pumped. There were another 11.3 billion gals. pumped in October. Meanwhile, Station 5A was operating her pumps every month of the year, recording 15.9 billion gals. in August, 21.2 in September, 9.8 billion in October. Heavy winter rains began in mid December and the system faced its biggest test. By the end of Jan. 1958, in less than six weeks, Station 5A had pumped 60.9 billion gals. of water from her intake canals to Conservation Area No. 1. In the same period, Station 2 pumped 33.6 billion gals. from the canals into Lake Okeechobee.

Florida weather again provided plenty of water to test a new station. Pumping Station S-3, at the Lake Okeechobee end of the Miami Canal near Lake Harbor, Fla., was nearing completion in late Summer of 1957. Her three 960 hp Fairbanks-Morse diesels drive F-M vertical axial flow pumps, each with a rated capacity of 860 cfs at a 6.4 ft. static head. The heavy September rains put the station to work ahead of schedule and in 140 unit-hr. the pumps handled 3.2 billion gals. of water. In October, the work was stepped up to 255 hr. and 5.9 billion gals. Then, after a month's respite, the new station took its share of the December-January downpour. The pumps were in service 1,018 hr. and transferred 23.6 billion gals. from the canal into the lake. There was substantial damage to crops and herds in the persistently cold and wet winter of 1957-58, but unofficial estimates credit the FCD's pump plants with a saving of $37,205,265. In little more than two years, with

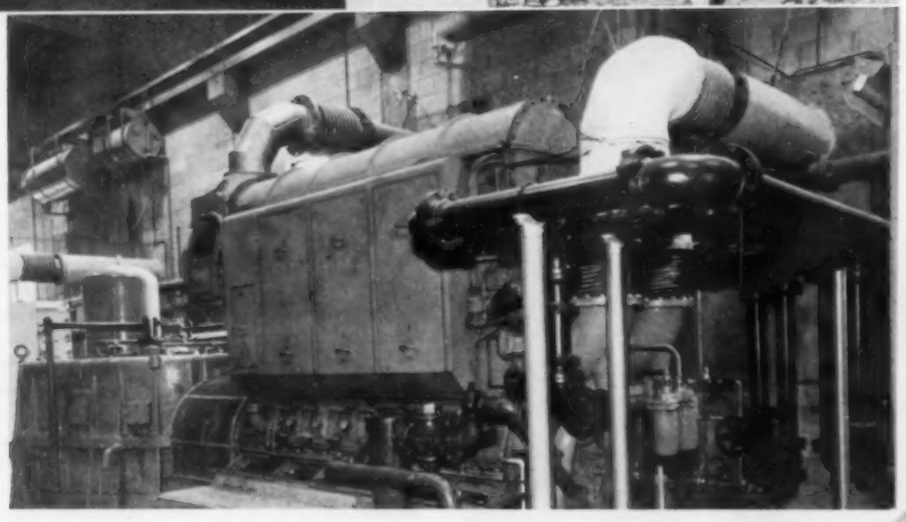


Station 3 is the newest in the system, with three F-M diesel-driven pumps handling a drainage area of 129 square miles. This view of the suction side shows the Maxim exhaust silencers, American air filters and the S. Morgan Smith trash rack rake.

duction gears. To make the pump stations truly self-sufficient, each is equipped with diesel-generator sets to provide electricity for lighting and motor-driven accessories. At S-2 there are three 75 kw model 49B4½ F-M diesel-generator sets and at S-3 there are two 100 kw model 62504 General Motors sets.

The design engineers calculated that these emergency stations would operate relatively few hours a year. Actually, the pumps have been used far more than anticipated. In 15 months, from January 1957 through March 1958, Station 5A has run 5,970 unit-hr. and pumped more than 137 billion gals. The station was in service every month of that period. In the same stretch, but operating in just 11 months, S-2 worked 3,650 hr. and pumped more than 103.6 billion gals. From September 1957 through March 1958, with service in just six months, S-3 recorded 1,916 unit-hr. and pumped nearly 44.5 billion gals.

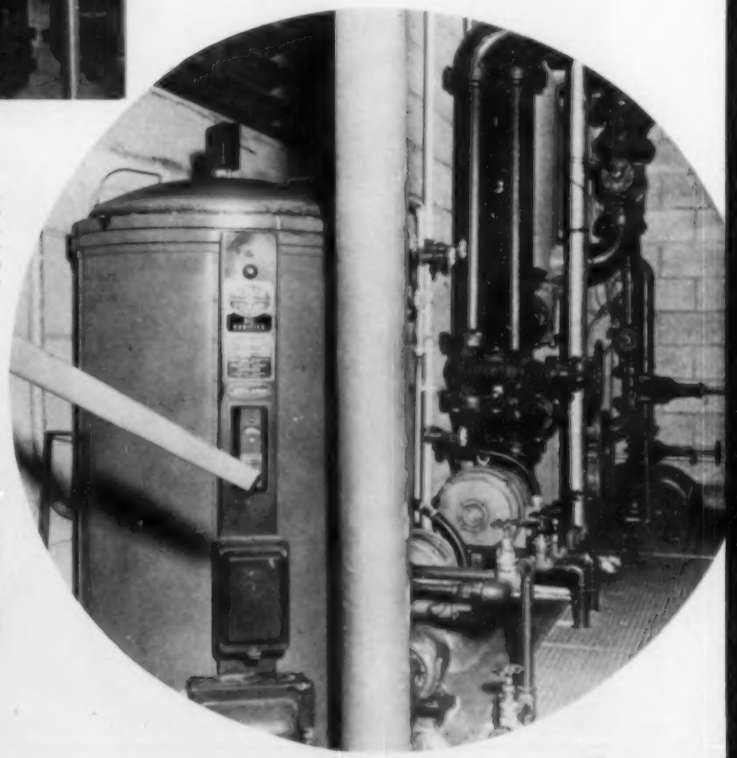
Already, the pumping stations have more than paid for themselves and unquestionably will continue to return important dividends to the people of Florida for decades to come. Meanwhile, the control system and the protection it affords continue to grow. Currently under construction is Station S-7 where three Fairbanks-Morse diesels will drive three 830 cfs F-M horizontal axial flow pumps. Soon S-7 will join the stations now in service protecting Florida cities against flood damage, protecting Florida farms against the twin menace of flood and drought.



the system still incomplete, the flood control installations have achieved the impressive saving of $44,705,265.

New stations S-2 and S-3 have much in common. Both have Fairbanks-Morse vertical axial-flow pumps with big 131.5-in. impellers. The four units at S-2 are rated at 900 cfs at a 7.2 ft. head, operating at 75.1 rpm. In service, head has been somewhat lower and actual volume pumped has been a high 1050 cfs. The three pumps at S-3 are rated at 860 cfs at a 6.4 ft. head, operating at 71.9 rpm. The new stations are self-powered and fully independent. This is essential in a system which is most urgently needed when the weather is most violent and electric transmission lines most vulnerable. In S-2 and S-3, each pump is driven by a F-M opposed-piston diesel. At S-2, the diesels are 8-cyl. units rated at 1160 hp at 625 rpm and the S-3 engines have 6 cyl. and develop 960 hp at 720 rpm. They drive their pumps through right-angle, hollow-shaft gear reducers. At S-3, there are flexible couplings between engines and re-

This view of one of the F-M opposed-piston diesels at S-3 shows the Air Maze full flow lube filter, Roper pre-lube pump, the Philadelphia Gear Works reduction gears, and the Nugent fuel oil filters. Engines use Woodward governors.



Each of the opposed-piston diesels at S-2 is served by a full complement of auxiliary equipment including a Honan-Crane lube oil purifier, Roper pre-lube pump, Fairbanks-Morse jacket water pump, Kewanee-Ross heat exchanger and oil cooler, and Sarco thermostatic proportioning valves.

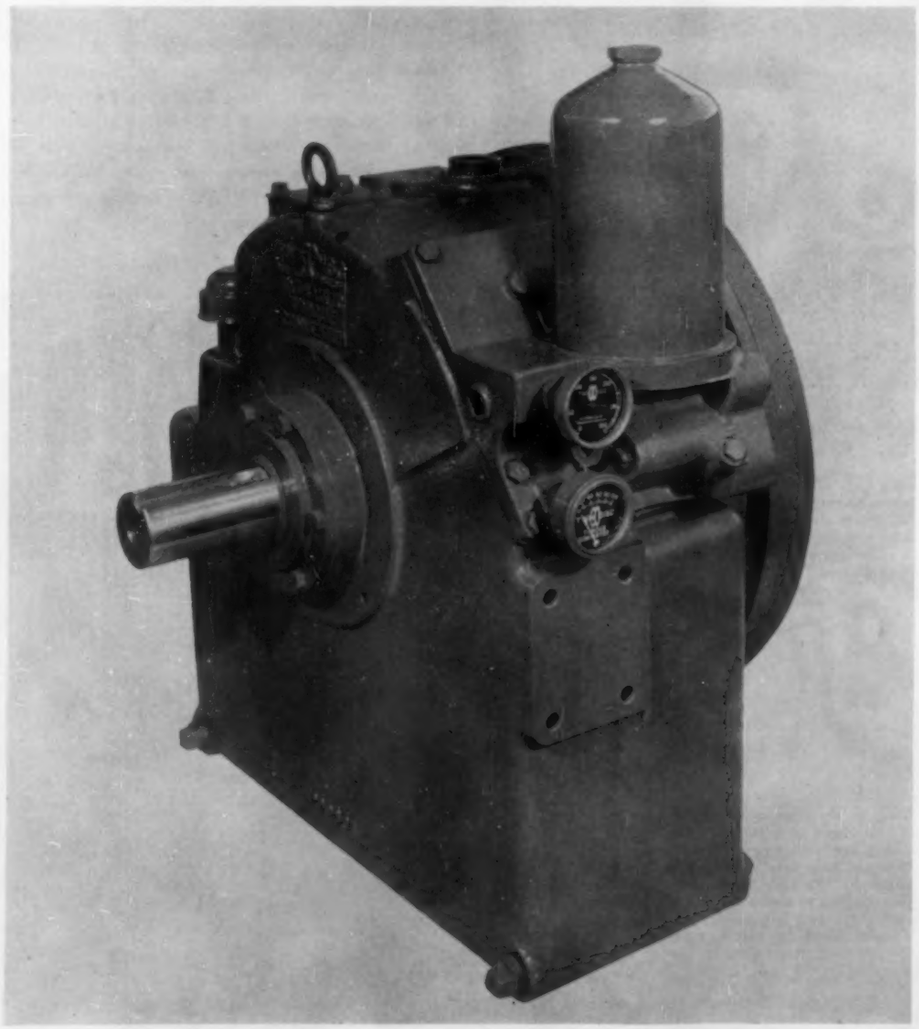
VERSATILE SINGLE-STAGE TORQUE CONVERTER DESIGNS

By E. B. FALK

E. B. Falk, Administrative Assistant, General Sales Department, Twin Disc Clutch Company, Racine, Wisconsin.

Two Different Sets of Output Performance Curves Permits the Equipment Designer to Match Torque Converter Closely to His Specific Design.

A BASIC advantage of three-stage torque converter design is its high stall torque capacity, which ranges from four and one-half to six times engine torque. In certain types of machinery, however, this high stall torque cannot always be used advantageously. For such applications, the less expensive single-stage torque converter is a more logical purchase. These facts led Twin Disc to augment its three-stage line with its current single-stage line. In developing the single-stage line, it became apparent that a prime limitation of the rotating housing single-stage torque converter was its relatively fixed type of performance curve. From knowledge of this limitation, a new design concept began to emerge: Could the same basic converter be designed with two circuits, essentially similar in mechanical design, which would provide two completely different sets of output performance curves? Twin Disc engineers already had an extensive background in the design of rotating housing fluid couplings. These couplings use a unique pear-shaped circuit which produces high capacity and high efficiency within a relatively small space package. Thus initial design work centered around this basic circuit except, of course, a guide stage or stator was required to provide torque multiplication.



Twin Disc 1500 series single-stage torque converter.

One approach was to design a circuit which would unload the engine at high output shaft speed by having the turbine develop a counter-rotational head. This circuit is shown schematically as a part of Figure 1. Note in Figure 1 that the position of the guide stage or stator is directly below the impeller so that the path of the oil flows in an outward direction from the center of the circuit across the stator blades. This is the Twin Disc Type 1 outflow circuit. This circuit provides a unique primary torque curve. Primary torque is the torque absorbed by the impeller at a constant input speed while the turbine ranges from stall to full racing point. The most significant attribute of the Type 1 outflow circuit is that the engine virtually is unloaded at a speed ratio of approximately .825. See Figure 2. This condition tends to establish its own output shaft governor, a factor which can be highly advantageous in some types of machinery such as power shovels. Note also that the torque demand on the engine at stall is relatively low, this tending to unload the engine. This can be advantageous in machines which require considerable power to be fed to oil pumps and other auxiliaries.

Simultaneous to the design work of the Type 1 circuit, another circuit was being developed which would have extended performance at the high

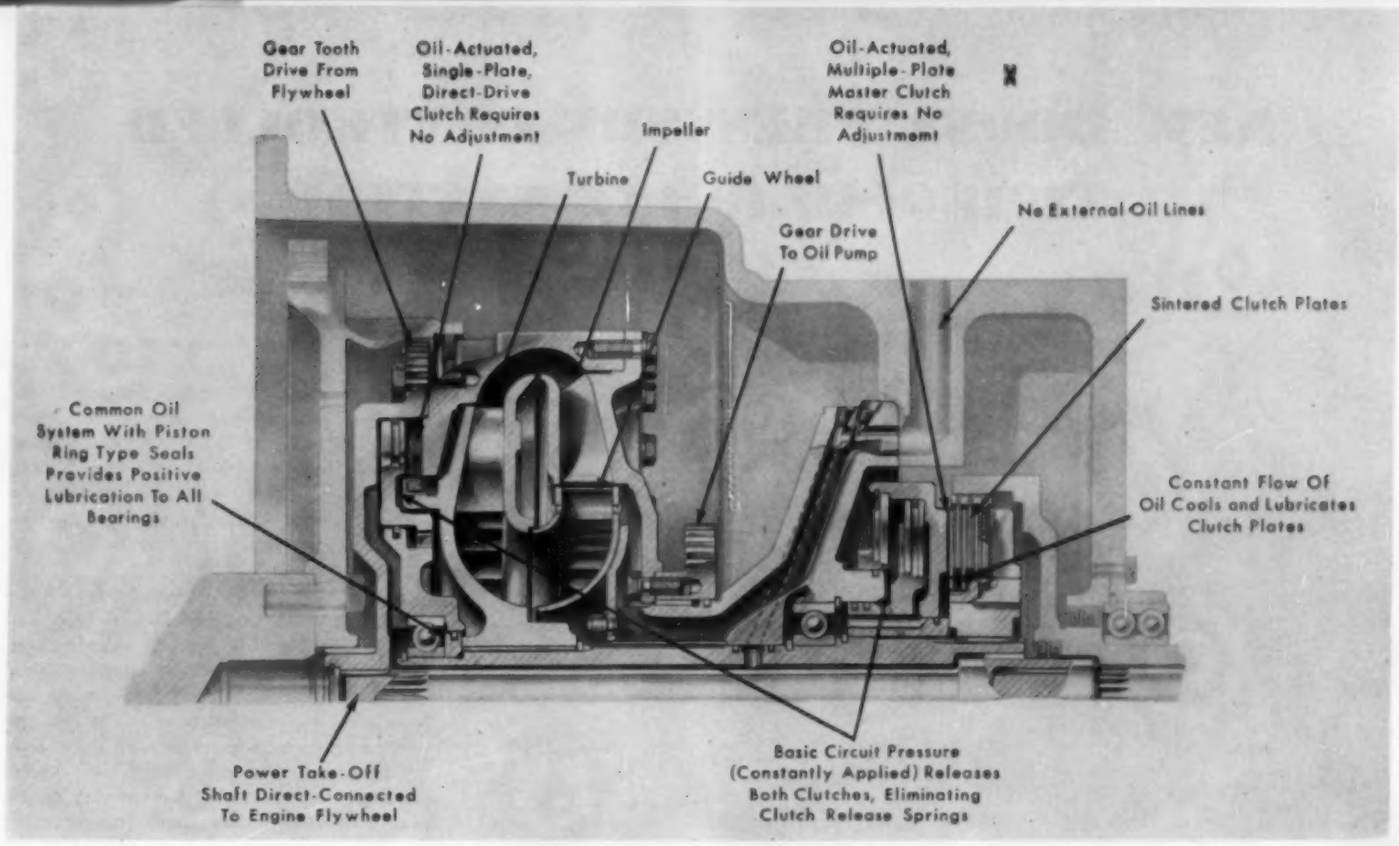

Gear Tooth Drive From Flywheel
Oil-Actuated, Single-Plate, Direct-Drive Clutch Requires No Adjustment
Impeller
Turbine
Guide Wheel
Oil-Actuated, Multiple-Plate Master Clutch Requires No Adjustmemt
No External Oil Lines
Gear Drive To Oil Pump
Sintered Clutch Plates
Common Oil System With Piston Ring Type Seals Provides Positive Lubrication To All Bearings
Constant Flow Of Oil Cools and Lubricates Clutch Plates
Power Take-Off Shaft Direct-Connected To Engine Flywheel
Basic Circuit Pressure (Constantly Applied) Releases Both Clutches, Eliminating Clutch Release Springs

Figure 3

speed end of the curve. Since the Type 1 circuit has a relatively low stall torque ratio, the second circuit was being designed for higher stall torque performance. To accomplish this, the stator was switched from under the impeller to a point directly beneath the turbine while retaining the same pear-shape design. This new circuit design is shown schematically as a part of Figure 1. This design produced a striking change in the primary torque curve as shown on the right side in Figure 2. The racing point moved out to 1.15:1 speed ratio and the higher absorbed torque at stall produced a moderately increased output stall torque. This is the Twin Disc Type 6 circuit and is applicable to a boader range of machinery than is the Type 1, particularly in vehicles where the high speed end of the curve can be utilized. Since the Type 1 lends itself particularly to direct drive performance with a lock-up clutch, an interesting feature of what can be done with a Type 1 circuit is illustrated in Figure 3. The unique circuit providing the unloading feature at .825 means that the impeller and turbine can be clutched together even though the stator is still in the circuit.

These single-stage units enable the design engineer to match the converter's absorption torque very closely to the engine's rated torque. This is done by offering four different sizes of circuits—the 1100 Series, 1300 Series, 1500 Series and 1800 Series— and by supplying five different impellers for each size. The series number indicates roughly the diameter in inches of the circuit divided by 100. This availability of four different circuit sizes each with five different impeller sizes and each unit offering two different sets of output performance curves permits the designer to match the converter to his specific design and minimizes compromising the design objective by matching the machine to the converter.

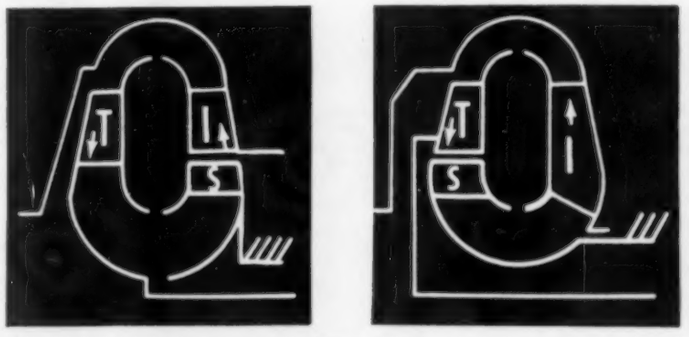


FIG. 1

Schematic drawings of the two types of single-stage circuits. The Type 1 (outflow) circuit is at left. Type 6 (inflow) is at right.

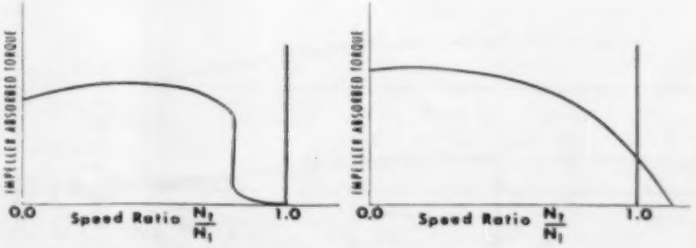
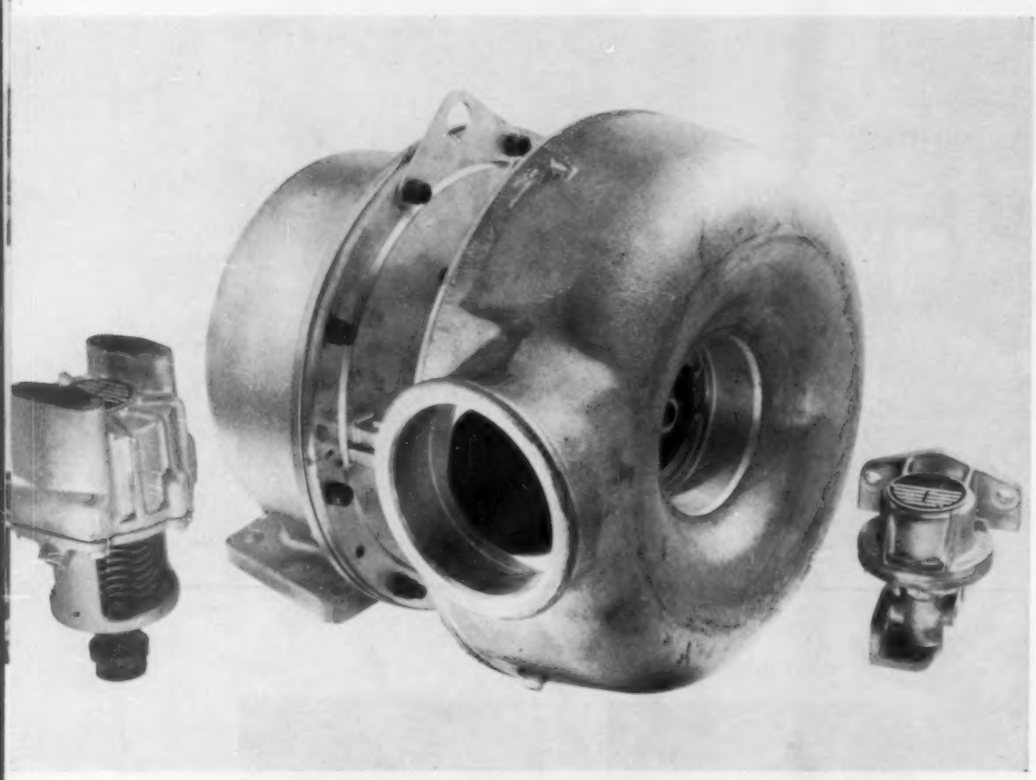


FIG. 2

A comparison of the torque characteristics of the Type 1 circuit (left) and the Type 6 circuit. The Type 1 circuit unloads the engine quite abruptly at a speed ratio of about .825. The Type 6 design allows a no-load speed ratio of 1.15:1.

NEW BOOST PRESSURE CONTROLLED TURBOCHARGING SYSTEM



Units making up the AiResearch pressure-ratio control system are shown with an AiResearch turbocharger. On the left is the exhaust by-pass valve, and on the right is the pressure-ratio sensor. The system is produced by The Garrett Corporation's AiResearch Industrial Division, Los Angeles.

A NEW system has been developed that combines the high power output and efficiency of the modern turbocharged engine with the flexibility of the naturally aspirated engine. This combination of power advantages is realized with the boost pressure controlled turbocharging system now in production at The Garrett Corporation's AiResearch Industrial Division, Los Angeles. Units have already acquired extensive operational experience and are standard production items on some Caterpillar Company tractors.

Developed for use with the entire family of AiResearch turbochargers, the boost pressure control system provides two basic types of design improvements. These improvements are accomplished by controlling the speed and acceleration of the turbocharger. First, improved turbo acceleration provides better engine response or snap and reduces exhaust smoke when under heavy load. Second, improved torque characteristics provide greater peak horsepower, greater engine lugging ability for heavy work with minimum gear shifts, together with reduced engine stress levels.

Modern turbocharged diesels utilize an efficient supercharging unit driven with exhaust gas energy. This device has made possible both increased power and decreased fuel consumption. However, engines supercharged with conventional, free-floating turbochargers are subject to two operating limits which influence the power plant behavior. At low engine speed, engine torque is limited by the decreasing amount of combustion air avail-

Figure 1

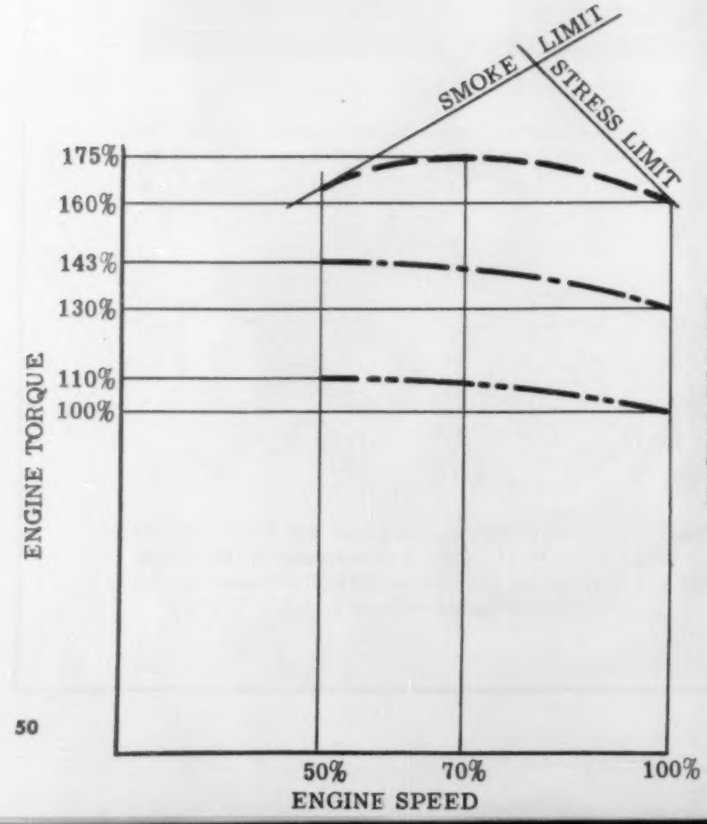
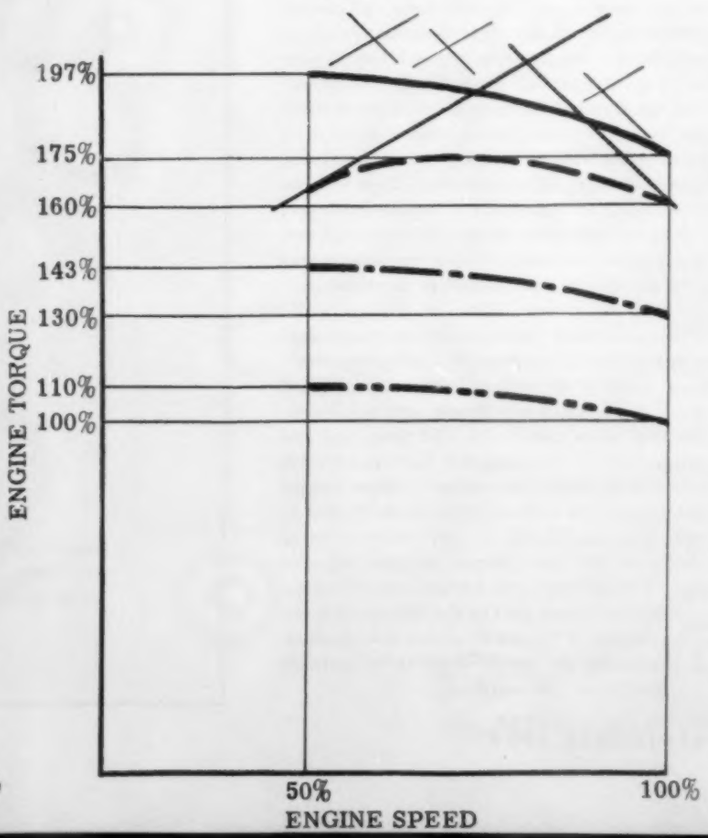
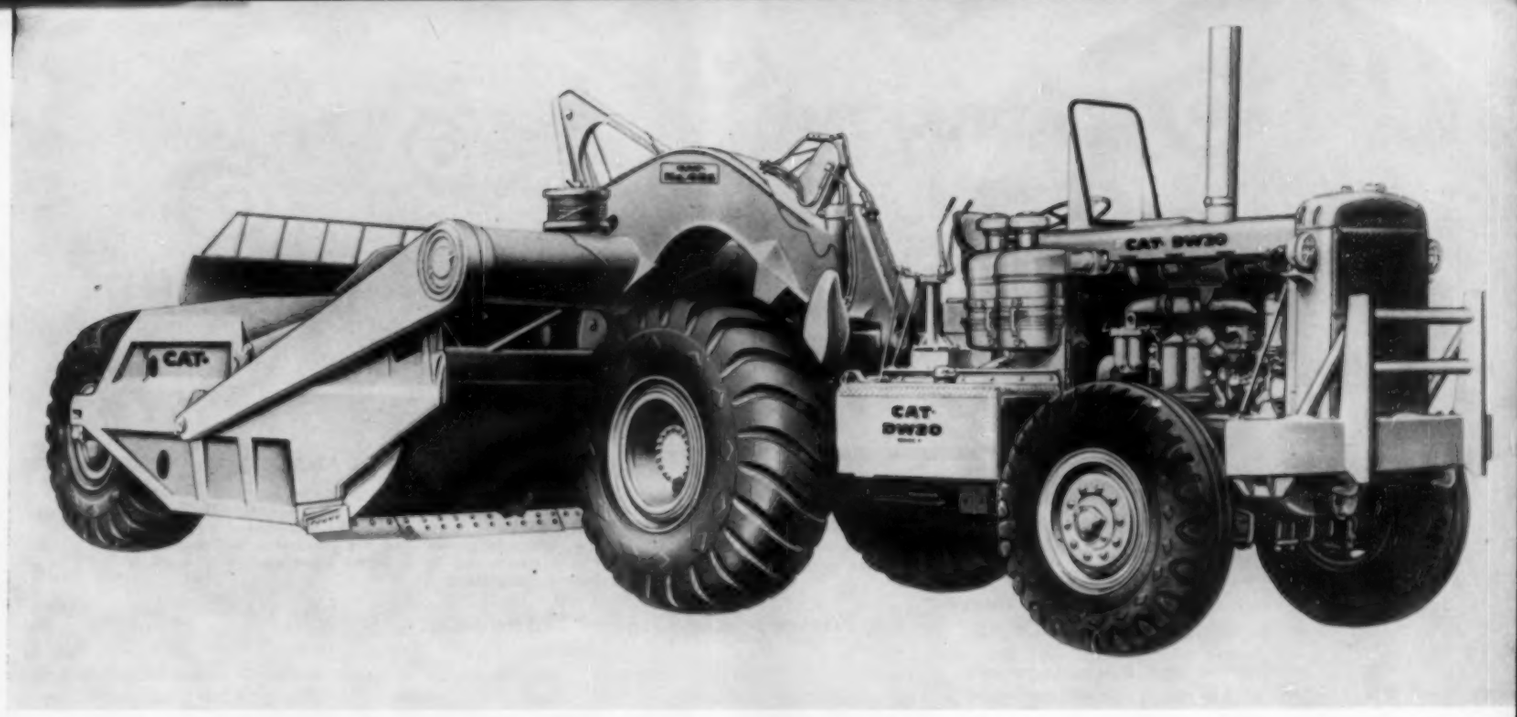


Figure 2





Caterpillar DW 20 wheel tractor equipped with AiResearch boost pressure control turbocharging system. Twin air cleaners and large exhaust stack handle increased combustion air flow.

able as the turbocharger speed drops. This is the smoke limit example shown on Figure 1. At high engine speeds, torque is limited by the stress limit line shown. This line, a typical limit for a well-matched turbocharger and engine, represents either turbocharger speed stress or engine pressure stress. Other limit lines may be selected.

The torque curves of turbocharged engines have been worked out under these two limits. According to AiResearch, conventional turbocharger application reduces the relative lugging ability of the engine by increasing the speed at which maximum engine torque is derived. This is also shown in Figure 1. The boost pressure controlled turbocharger removes these limitations. Action of the control is to maintain the most desirable turbocharger speed over a wide range of engine speeds, as shown in Figure 2. With this control, the engine operator can have his cake in the form of peak power and eat it as well in the form of engine lugging ability surpassing that of the naturally aspirated engine. The controlled turbocharger thus combines the high power and efficiency peak of the turbocharged engine with the torque flexibility of the naturally aspirated type.

The AiResearch controlled turbocharger system operates by a simple principle. The turbocharger is matched to the engine with a turbine nozzle of a precisely selected size to drive the turbo unit fast enough to provide quick response and maximum torque at the lowest engine speed desired. AiResearch engineers report that this directly results in optimized engine torque characteristics and greatly improved engine response. As engine speed increases, the boost pressure control system acts to maintain desired turbocharger speed by conducting excess of exhaust gas around, rather than through, the turbine.

To sum up in review: Rapid turbocharger response to engine load changes has become increasingly important as power levels increase. The boost pressure control system provides high response rates as is shown in Figure 3. In response to an increase in engine load, a controlled turbocharger, heading toward a high potential equilibrium speed, accelerates much more rapidly than an uncontrolled turbocharger. As the desired turbocharger equilibrium speed is reached the pressure control takes over and maintains this speed. Thus as shown in figure 3, the time required to develop the desired amount of combustion air is greatly decreased.

Caterpillar DW 20 and DW 21 wheel tractors are equipped with the AiResearch boost pressure controlled turbocharging system. The system provides equal rimpull for these tractors at up to 10 per cent higher travel speeds. In addition to more than double torque rise, improved lugging and acceleration characteristics, other benefits experienced include decreased specific fuel consumption and reduced smoking. Extensive tests with installations on over-the road truck operations have been conducted by AiResearch. Results show an average 5 per cent increase in fuel mileage over normally turbocharged diesels. This margin is 10 per cent over non-turbocharged models and in individual cases as high as 21 per cent.

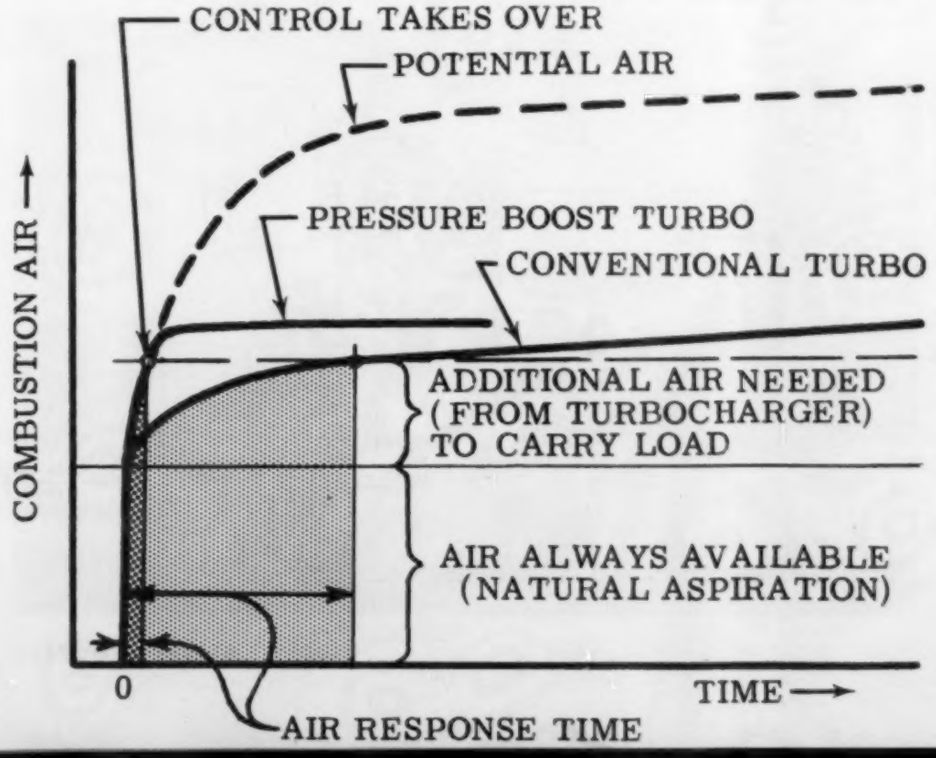


Figure 3

WHAT'S GOING ON IN ENGLAND

CONDUCTED BY **BERNARD W. LANSDOWNE**

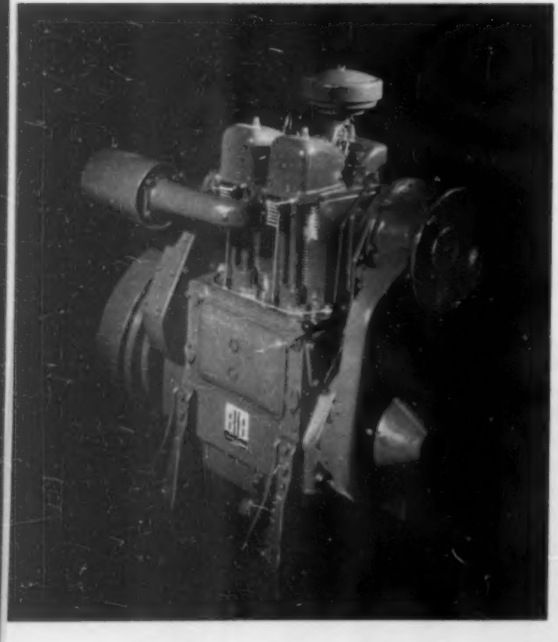
Bernard W. Lansdowne is an associate member of the Institution of Mechanical Engineers and is widely known among British and European diesel manufacturers as a former editor of our English contemporary "Gas & Oil Power." His early workshop training was spread over seven years with A.E.C. Ltd., Southall, following which he served some five years with that company's sales engineering department. He is now specializing in industrial advertising with Roles & Parker, Ltd. in London.

New Ruston Air Cooled Range

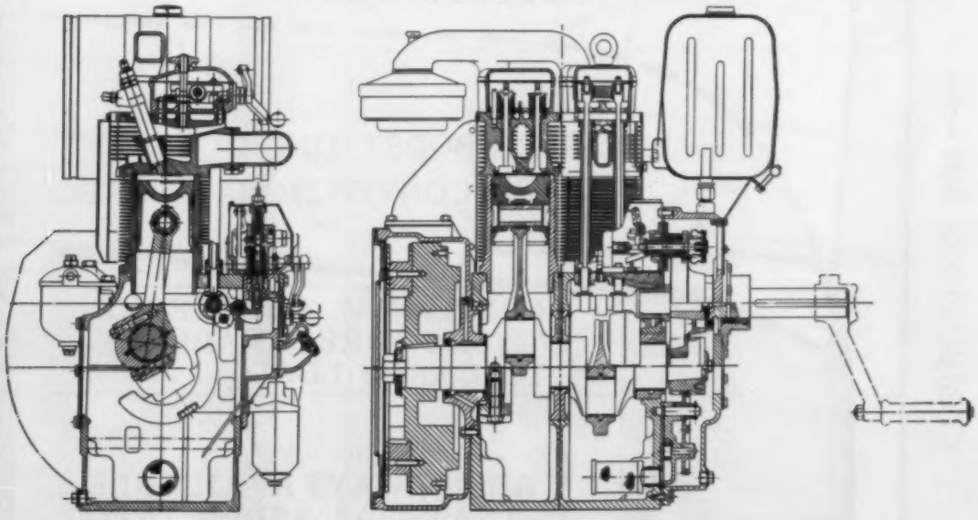
JUST over a year ago, Ruston & Hornsby Limited, of Lincoln, England, introduced their first air cooled diesel engines, known as the YBA series, in single and twin cylinder form, to give from 4 to 12.5 bhp at 1,800 rpm. Two new air cooled series are now announced by Rustons, extending the power range up to 110 bhp. The smaller of the new designs, known as the Type YWA, is a four cycle engine of 4 in. bore by 4⅛ in. stroke, manufactured in single and twin cylinder units to provide from 6 to 24½ bhp, as an automotive rating over a speed range of 1,000 to 2,200 rpm. The British standard rating is from 6 to 19 bhp at 1,000 to 1,800 rpm. The other new series, known as the YDA, is based on a cylinder size of 4⅜ in. bore by 5 in. stroke and is available in 2, 3, 4 and 6-cylinder form. Automotive rating for the YDA is from 16 to 110 bhp, at speeds from 1,000 to 2,200 rpm, and the British standard rating is from 16 to 87 bhp at 1,000 to 1,800 rpm.

The basic design details throughout the two series are generally similar, an important feature being the construction of the cylinder head and barrel. These are aluminum Y alloy castings adequately finned for efficient cooling. Strength of the cylinder head lies in its box-like construction, the top deck and bottom deck being spaced apart by the two main strengthening members which incorporate the valve ports. This construction allows the main stream of cooling air to pass through the center of the head, thereby effectively cooling the fuel injector and the valves, and maintaining an even temperature throughout the head with the total elimination of any local hot spots. Both engine designs are fitted with a duct which carries the air along the entire length of the engine and directs it through the spaces between the fins of the cylinder head and barrel. The duct is easily removed from the engine to facilitate cleaning. The YDA engine has an axial flow fan fitted at the end of this duct which is driven by vee-belts from the crankshaft pulley; a belt tensioning device permits adjustment. The YWA unit has a centrifugal fan mounted on the flywheel, the volute casing of which is connected to the duct by an elbow. The under-side of the cylinder head is recessed to accommodate the cylinder barrel spigot and contains the high-grade cast-iron valve seat inserts. The cylinder head and barrel are attached to the crankcase by long, high tensile steel studs. This simple arrangement permits the rapid removal of the cylinder head, barrel, and piston. This construction results in the cylinder head and barrel being under a compressive strain at all times and it is important to note that there is no gasket between the cylinder head and the cylinder barrel. Design of the YDA engine has been arranged to permit the assembly of all the auxiliaries, such as fuel injection equipment, air, fuel and lubricating oil filters, etc., on one side of the engine or the other. This allows the hot air to issue from the cylinders on whichever side of the engine is desirable. Furthermore the YDA crankshaft is so designed to enable full power to be taken from either end and thereby caters to reverse rotation machinery. Similar versatility exists with the YWA engine so that full power can be taken from either end of the crankshaft and from the half-speed shaft. It also is made as a reverse rotation unit which, in addition to catering for the driven machinery, allows the direction of rotation of the starting handle to be selected in any of three positions.

Ruston 2YDA air-cooled diesel.



Ruston YWA Diesel sectional arrangement.

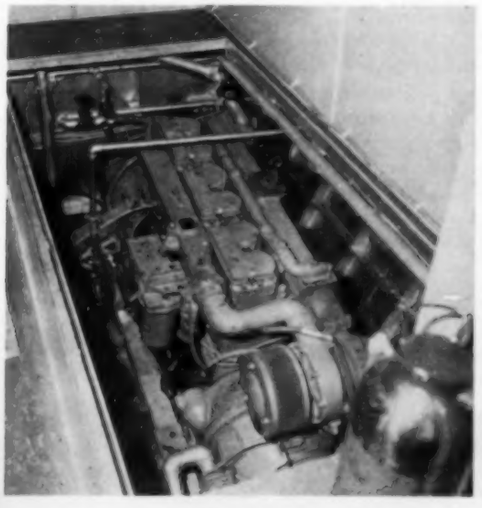


RUGGED OFFSHORE BOAT USES CUMMINS DIESELS

AN exceptionally seaworthy craft of unusually heavy construction for carrying personnel to offshore oil rigs recently was put into service by W. A. Richmond of Morgan City, La. Christened the *Esther G*, the new crew boat is 48 feet long. It was built by Sewart Seacraft, Berwick, La., to comply fully with Coast Guard regulations for offshore vessels carrying personnel and is certified by the Coast Guard for this type of service.

To meet the rugged requirements for speed on this heavy boat, two NRTOM Cummins turbodiesel engines were chosen for the power. They speed the boat along at 22 mph while providing safe, dependable transportation for passengers. The *Esther G* is designed to carry twelve or more passengers and can carry as many as seventeen. The engines were purchased through the New Orleans branch of Cummins Sales & Service, Inc.

Powerful Cummins Turbodiesel engines drive the *Esther G*, latest addition to the offshore crew boat fleet of W. A. Richmond.



Closeup shows how engine is mounted. The two Cummins turbodiesels turn 32-inch propellers with 28-inch pitch.

The Twin Cummins turbodiesel engines turn 32-inch propellors with 28-inch pitch. The reduction gears are Capitol hydraulic with a 2 to 1 ratio. The *Esther G* will be leased with a licensed pilot. The W. A. Richmond company is one of the pioneers of the crewboat contract business in the Morgan City area. The new vessel is being added to a proven, successful fleet which has specialized in leasing to major offshore oil companies.

GAS TURBINE PROGRESS

A COMMENTARY BY R. TOM SAWYER

R. Tom Sawyer's well known in the gas turbine field having been the first chairman (1944) (and now treasurer) of the Gas Turbine Power Division of ASME. He spent 7 years with G.E. Transportation Dept., and 26 years with American Locomotive, now Alco Products. At present he is a Consultant, including "Consultant to the Staff" of the Experimental Towing Tank at Stevens Institute of Technology. In addition to being a Fellow Member of ASME and AIEE, he is a member of SAE, ARS, ANS, IME in London, DEUA in London. He is also a member of Franklin Institute and a Professional Engineer. Mr. Sawyer is the author of *The Modern Gas Turbine* and *Gas Turbine Construction*, and co-author of *Applied Atomic Power*.

General Electric Gas Turbine Locomotive

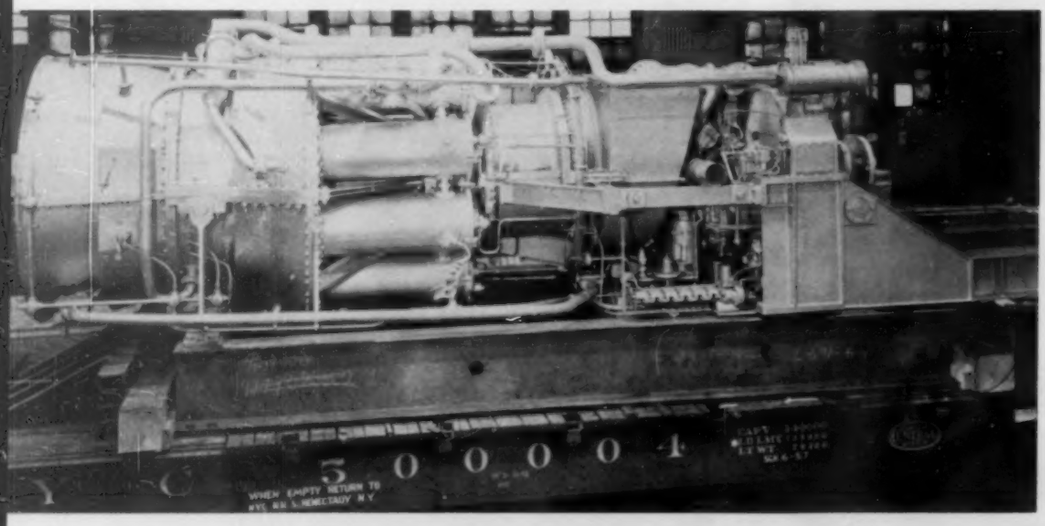
MEDAL Day is held each year in October by Franklin Institute at which time medals are presented to various scientists, engineers, and others who have performed some outstanding work. Among these is the George R. Henderson medal which is awarded for meritorious inventions or discoveries in the field of railway engineers. This October the citation for the Henderson medal will be awarded to Arthur H. Morey for his engineering contributions to, and his effective leadership in, the overall design, development, and service testing of the successful 4800 hp General Electric Company gas turbine-electric locomotives.

One of Morey's first duties for General Electric was project engineer on their steam turbine electric locomotive, developed in the 1930's. This locomotive not only saw service on the Union Pacific but on various other railroads. It had difficulties as all other steam turbine locomotives seem to have and was eventually scrapped. Then Morey worked on the development of the first gas turbine aircraft power plants including designing of gear transmissions and turbo propellers as well as jet power plants. This experience combined with that of the steam turbine locomotive made him an ideal man to head up the project work at the Erie Works of the General Electric Company for their gas turbine locomotives. Before the first demonstrator locomotive was created considerable development work was required to produce the gas turbine for this unit, and in March 1948 General Electric had a demonstration at Schenectady before various railroad officials exhibiting this first locomotive turbine on the test block. It was not until November 15, 1948 that the locomotive itself with this turbine operated under its own power for the first time on the test track at the Erie Works of General Electric. This was America's first gas turbine locomotive and history was made that day.

This first demonstrator locomotive was rated 4500 hp to the main generator for electric traction purposes. However it had to develop greater power than this to handle the auxiliary loads and developed a total of approximately 4800 hp at 80° F. ambient temperature. The generator and eight traction motors were capable of absorbing 6000 hp which could be produced by the turbine in cold weather. This is one of the advantages of the gas turbine locomotive. The greatest advantage of the gas turbine locomotive over the steam turbine locomotive is the simple fact that the gas turbine locomotive does not have a boiler. This demonstration unit operated for several years on the Union Pacific System. An order was then placed for similar 25 units. These units at first had their difficulties but Arthur Morey and his team, working night and day, together with the Union Pacific maintenance personnel, finally produced a fleet of successful, highly reliable motive power units. It is for this work that Morey received the Henderson citation.

The Union Pacific then became interested in more gas turbine locomotives and it was finally decided to produce a three unit locomotive having one turbine rated 8500 hp. This has kept Morey and his many associates extremely busy for the past two to three years. The first fleet of ten locomotives this size are due to be operating on the Union Pacific System this year. Each locomotive consists of an A and B unit. The A unit has the operating cab with all controls and essentially all auxiliaries including: diesel generating set used for auxiliary purposes and hostling the locomotive using two of the 12 traction motors; all diesel controls and a 2500 gallon fuel tank of diesel oil; and air brake compressors and electric braking resistor grids. The B unit has certain turbine controls and the gas turbine generator unit capable of producing 8500 hp at 6000 ft. altitude and 90° F. ambient air temperature. The tender has unusually high fuel oil capacity of 24,000 gal.

The original 25 locomotives are now all equipped with a 21,000 gal. fuel tender in addition to the 7,000 gal. of fuel originally provided for on the locomotive. High storage of fuel on board allows long through runs without stops, with highly perishable goods. This is the ideal service requirement of the heavy duty gas turbine locomotive. Main object of the Union Pacific System is to handle freight fast and efficiently and it is now doing that not only with steam but with diesel and now with the present fleet and soon with the new fleet of gas turbine locomotives.



8500 hp locomotive gas turbine unit made at the Schenectady Works and installed in the locomotive made at the Erie Works of the General Electric Company.

IRRIGATION EFFICIENCY

MOST nursery growing areas of South Florida would have enough annual rainfall for a good crop of plants if the rains were spread over the year evenly. But, South Florida, in the subtropical belt of the United States, has either too much or too little and as such needs irrigation during the lean dry months of the winter season. This was the case of W. H. Booth of the Booth Nursery of Davie, Fla. After trying several makeshift gasoline engine driven water pumping units without success, he decided to install a dependable diesel-driven water pump. Booth selected a General Motors 2 cycle 6 cylinder diesel engine with a continuous output of 142 horsepower and coupled to a Fairbanks-Morse 10 inch inlet, 8 inch discharge pump, having a discharge capacity of 2500 gpm at 75 lbs pressure.

This new installation enables him to irrigate his 8 acres of plants in approximately an hours time. Seventy-five #70 and #80 rainbird sprinklers are currently being used in the system. During the several freezes, last winter, the new diesel pumping unit paid for itself several times over as it operated steadily during the early morning hours.

General Motors diesel driven pumping unit in the bank of the South New River Canal at Davie, Fla. It was engineered and installed by Ellis Diesel Sales & Service and has a Maxim silencer and Vortox air cleaner.

TWO MORE TRAWLERS FOR GULF WATERS

RECENTLY launched and already shrimping in the Gulf of Mexico are the two new shrimp trawlers *Gold Digger* and *Hep Cat*. They were designed by Tams Inc. and built by Diesel Engine Sales of St. Augustine, Fla. The 67x18 ft craft are of wood construction and are complete package units which are so popular with the shrimp trawler owners.

Both vessels are owned by the Versaggi Shrimp Co. of Tampa. Propulsion power for both vessels is supplied by model D342 Caterpillar diesel engines. Each has a maximum horse power of 210 at 1225 rpm or a continuous horsepower of 150 and swings a 50x34 four blade Columbian propeller through a 3:1 r&r gear. Walter Clean-flo keel coolers are used for main engine cooling.

Auxiliary light plants are 1500 watt Petter diesel generating units. Engine room layout provides excellent accessibility to all machinery. Welded steel fuel oil tanks are on either side of the vessel with a total capacity of 5000 gallons.

The 67 ft shrimp trawler *Hep Cat* on its trial run after launching by Diesel Engine Sales of St. Augustine, Fla. Both the *Hep Cat* and *Gold Digger* have a tonnage of 63 gross, 30 net. The Caterpillar diesel engines were supplied by The Gibbs Corp. of Jacksonville.

DIESEL SERVICE PROGRESS

A COMMENTARY BY **GEORGE R. MACKEY**

George R. Mackey was long associated with Detroit Diesel Engine Division of General Motors Corp., and had prior experience as a mechanic in Europe and the U.S.A., which enabled him to become well acquainted in the diesel and service fields and to obtain a broad scope of the service industry from the customer's and management's viewpoint. Further training at Carnegie Tech and in the Army Ordnance during World War II provided the necessary requirements in planning service programs. Progressive advancement in diesel service areas in General Motors and with Detroit Diesel led to his position as Supervisor of Service Promotion. Upon termination of employment with General Motors in 1952, he joined Clayton Manufacturing Company, and his present position with this organization is Sales Manager of the Dynamometer Division.

Service Shop Productivity

Shop Space and Manpower

THE relationship between shop space and manpower, while appearing obvious, requires considerable planning. It is only natural to assume that if a service department had ten mechanics and no place for them to work, nothing would be accomplished. Likewise, if a service department had ample space but no mechanics, nothing would be accomplished. To accomplish work, make a profit and keep a smooth volume of service work flowing through the shop, there must be a balance between space and manpower.

While planning the operation of a service department and determining the proper balance between space and manpower, a service manager will be confronted with two questions—should he take the man to the job?—or, should he take the job to the man? While both of these methods are commonly applied to service operations, the benefits of each must be considered. Many shops specializing in sub-assembly repair and overhaul will use the —take the job to the man method, but this method may not be practical for shops specializing in heavy repair. To seek out the use of each of these two principal methods of operation would result in many variations and alternates relative to the application, or the combinations of the use of the methods. Some shops may use the—man to the job method almost entirely. Others may use this method for all but cleaning, dynamometer testing and painting, while others may use this method for all but cleaning, dis-assembly, testing and painting. As a service department increases in size, with a resulting increase in service volume, it is quite common to find more and more jobs becoming specialized, until the entire operation becomes more or less departmentalized.

Before trying to determine which of the methods is applicable to any particular operation, the number of working areas and the number of mechanics must be taken into consideration. From this consideration, it will generally be established that —the smaller the shop, the general will be the practice of—bringing the man to the job. As shop sizes progress, the method will change until, with large operations having adequate space and manpower, departmentalizing becomes a common practice. One of the advantages of using the man to the job method is that any space around the shop, or outside of the shop, can be utilized for production purposes if the shop area is small or overcrowded. This method can also be used for quick service adjustments or minor repairs. It allows considerable flexibility in the use of mechanics to offset the handicap caused by the lack of space. The advantages of departmentalizing the shop, or using the job to the man method of operation are: precision equipment can be placed in a specific location; special equipment too large or too heavy to move, or equipment requiring a permanent installation, can be better utilized. The mechanic assigned to a specific operation in a departmentalized shop has an assigned area in which he can keep his tools. He can be held responsible for the general appearance and cleanliness of the area, and can organize himself to do his work in the best, most practical manner for both speed and accuracy. Departmentalizing also provides for specialization of both work and training.

The purpose for studying these various methods of operation is not to determine which method will best suit any individual type or size of operation, but to bring forth the facts that will help a service manager realize the importance of reviewing and analyzing his own operation, and to take into consideration the balance between space and manpower when planning the production areas in the shop.

Wasted Production Space

One of the most important responsibilities of a service manager is to keep each productive area for productive work. While no service manager will deliberately allow space to be wasted, things detrimental to overall service productivity can sneak up on him. While things of a minor nature may waste just a little space, and go unnoticed for awhile, they soon lead to more and more loss of working space. Some of the most common causes of wasted productive space are: company vehicles parked in the service shop; new engines or equipment stored in working areas; used engines and equipment, or equipment taken in on trade stored in a production area; oil barrels stored in work areas; aisles too wide; bad lighting in dark corners; junk box too large, or placed in valuable work space; tool room in wrong location; improperly positioned work benches; engines or equipment torn down awaiting parts; and many others. The remedy for eliminating the waste caused by some of these items is to use other less valuable space for storage areas. Storage areas should be allocated for storing new and used engines and equipment, or storing jobs held up for any reason. Areas for stock room or tool room should be in the part of the shop that cannot be used for production space. Suitable lighting should be installed in dark areas. Good drop cords should be installed for working underneath equipment. Permanently installed equipment should be checked to see if it is paying in labor sales, or productivity for the space it is occupying. If aisles are too wide, utilizing some of the space to enlarge production areas, or to relieve conjestion, will add to shop productivity and labor volume. Each work area must be evaluated to determine if it is contributing to the overall shop operation.

A cluttered up service shop is generally one that has low service volume, low productivity, and is most likely looked on by management as a necessary evil. In such an operation, it would not be uncommon to find a dozen or more service jobs in the shop but only one or two being worked on. Generally, by reorganizing the shop working areas and rectifying the items listed previously as contributing to wasted space, production can be improved. By removing oil barrels, relocating junk box, adding a few light fixtures in dark areas, parking vehicles in the parking lot, etc., it may be possible to double or even triple the productive work space. Such increases can often be accomplished without any changes to the interior of the building.

Improvements For Greater Productivity

There are often many changes that can be made

to increase shop productivity, or get more working areas. While planning such changes, there are many facts that should be considered, such as: position and size of work areas, proper arrangement of equipment for those jobs that can be departmentalized, providing space for engine or equipment storage far enough inside building so as not to block doorways, setting up certain areas to care for new engine or equipment get-ready, seeing that other departments do not store equipment in working areas, division of the service shop with space allocated for the storage of necessary items required in the shop, and the allocation of production work areas with enough space to enable the service department to pay its own way and make a profit.

In many buildings, the smooth flow of work can often be improved, or additional work areas obtained, by alterations within the building such as moving a partition, changing aisle locations, etc. Many manufacturers offer a shop planning service. The wise service manager will take advantage of this experienced assistance while planning the shop layout. Before making costly changes to existing shops, some thought should be given to the number of hours work space is used. Inasmuch as the rent of shop space goes on twenty-four hours per day, we should take into consideration the number of hours the service shop is open each day. Eight–nine–ten hours? Perhaps using existing space more hours per day may be the most practical approach to increasing service volume and service productivity.

Due to the fact that floor space carries a high cost burden, and in many instances cannot readily be expanded, greater productivity may be possible with the same structural auspices. This can be done by making a closer, more exact study of the following important phases: Production area arrangement; work operation sequence; material handling; inter-department transport or handling of parts, sub-assemblies or equipment; storage problems; safety. When we consider that production spaces often comprise only a small portion of the total occupied floor space in many shops, and that the remaining space is taken up with offices, storage, material handling, etc., the value of each working area and the contribution each working area makes to the total profit becomes very important. Thus the problem of unproductive space becomes of paramount importance from an operational cost viewpoint. Only by continuing a close on-the-spot study and analysis of productive and non-productive space can the service manager operate a profitable department and control shop operating costs.

Expand Line of Drives and Couplings

A new expanded line of Flexidyne Dry Fliud Drives and Couplings ranging in capacity from one-fourth to 1,000 horsepower, is announced by Dodge Manufacturing Corporation, Mishawaka, Indiana. Added to the line are three larger sizes and a new small size for low horsepower applications. An 18 in. dia. Flexidyne is now available either as a drive for use with V-belts, or as a coupling for direct shaft-to-shaft connection. Either will deliver up to 200 hp at 1,200 rpm. Next larger size is the 22CK, available only as a coupling and capable of transmitting up to 800 hp at 1,200 rpm. Largest of the new units is a 27-inch coupling, 27CK, with a rating of up to 1,000 hp at 900 rpm. For medium light applications such as cranes, fans and small conveyors, the manufacturer has added a six-inch Flexidyne. This unit, available as a coupling or for use with V-belt drives, is rated at up to two horsepower at 1,800 rpm. This and a five-inch Flexidyne were designed for light duty, low-cost drives.

As a controlled acceleration device, Flexidyne employs a new principle for transmitting torque from motors or engines to driven machines. The "fluid" in Flexidyne drives and couplings is heat treated steel shot. A measured amount, called the flow charge, is contained in the housing, which is keyed to the motor shaft. When the motor is started, centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor, which transmits power to the load. After an initial period of slippage, housing and rotor become locked together and achieve full load speed, operating without slip and with 100 per cent efficiency. Torque capacity of all units may be tailored to suit individual drive requirements and to protect against overload by simply varying the amount of the flow charge. The full line of Flexidynes now available from stock consists of 18 units—eight drives and 10 couplings. New descriptive bulletin A-64OB is available on request. (ITS NEW)

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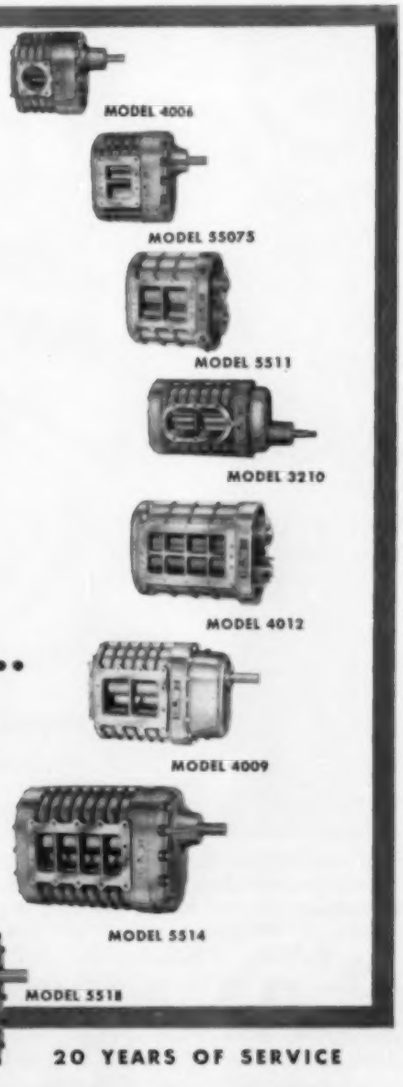

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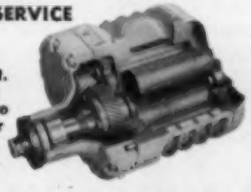

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Florida Diesel News

By Ed Dennis

NEW Royal Castle commissary plant in Hialeah will provide facilities for producing 50 million hamburgers a year. For protection against any power failure, Shelley Tractor & Equipment Co., installed two D337 series F Caterpillar diesel generating sets with 150 kw Cat generators.

DON Q II of Ponce P. R., a 45 ft. sports fisherman craft built at Chris Boat Works, had a pair of General Motors diesels, models 6087 and 6088, installed. These 6 cyl diesels deliver 235 shp at 2300 rpm and have GM 2:1 hydraulic r&r gears.

DADE Drydock Corp. delivered, to real estate developer Ben Cooper for his Kings Bay development, a 56x20x5 ft. dredge. The blueprint specifications call for a D337 series F 150 kw Caterpillar diesel generating unit. The model D397 Caterpillar (647 max hp) diesel drives a 10x12 Georgia Iron Works pump through a Cotta 2:1 reduction gear. The dredge also has a 6.5 kw Petter diesel emergency generator unit. The Kings Bay Yacht & Country Clubs million and a half dollar project includes facilities for golf, yachting and swimming.

A U. D. 525 six cyl International diesel, rated 125 hp at 1800 rpm, in a #118 Galion-Grade-O-Matic motor grader for John C. Peterson Construction Co. from Florida-Georgia Tractor Co. while the Atlantic Foundation Co. has a 76 hp 4 cyl International in a ½ yd General crane, both pieces of dieselized equipment are working on the cloverleaf at the new Miami International Airport.

DIESEL Engine Sales at St. Augustine, installed for auxiliary plants model 232 R air cooled 3 kw Onan diesel generating units on the newly launched *Estofleet* and *Wledamir Talts*. For main propulsion Caterpillar model D342 diesels rated 150 hp are being used.

SHELLEY Tractor & Equipment Company have opened their new Broward County office and shop at 1800 N. W. 23rd Ave., Fort Lauderdale, with 16,000 sq. ft. of space for sales and service. Jim Cunningham, with 20 years of Caterpillar experience, is branch manager, Marion Halpin is service manager and Fred Riley sales representative.

GENERAL Motor 3-71 diesels rated 72 hp at 1800 rpm with GM power take-offs and Commercial hydraulic pumps power the model 2460 multi-purpose Gradalls that Eddie Fuller and the Joe Reinertson Inc., contractors are using on the various ditching and sewer pipe line projects in South Florida.

THE *Good Hope*, a 63 x 14 yawl of Fort Lauderdale, was repowered with a model X, 4 cyl Ford diesel. This 220 cu. in. engine rated 68 hp is marined by Modern Diesel Power of Tampa and was sold by Southeast Diesel Marine of Miami. It has 1.5:1 Paragon r&r gears.

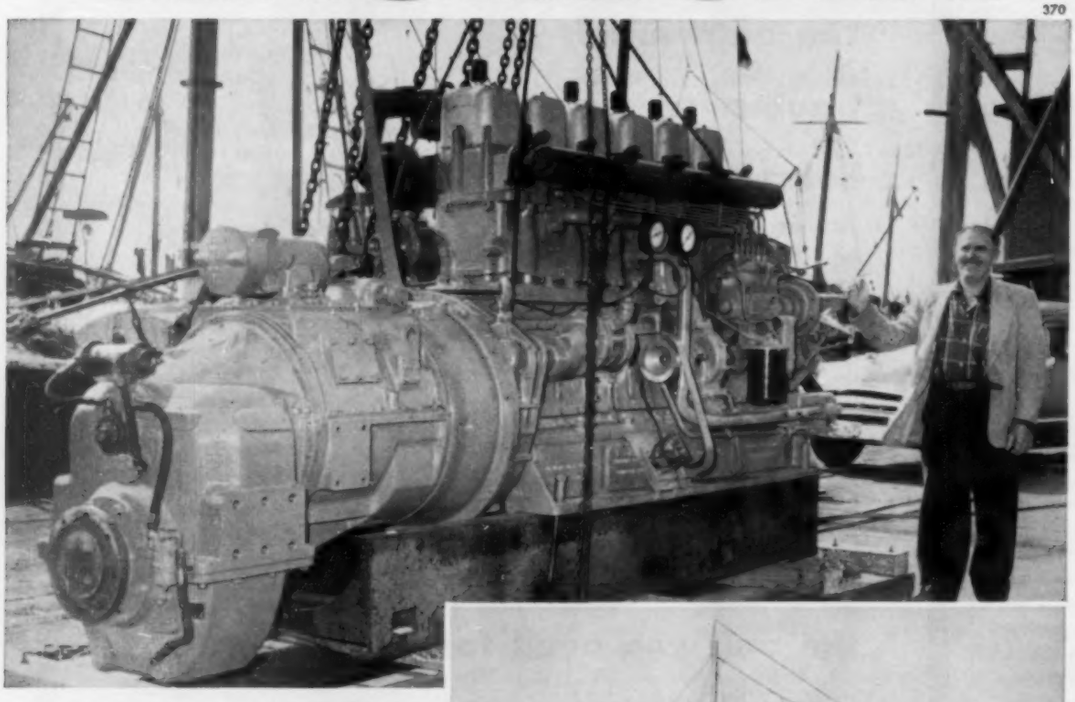
CUMMINS Marine Diesel installations were made by Cummins Diesel Engines of Florida in two fishing vessels for Willard Sands and Jack Hill, both are lobster fishermen out of Miami. Cummins J. N. S. 600 diesels with Capitol 1.5:1 r&r gears were installed.

BAY Dredging Co. of Tampa had an Allis-Chalmers, model 6-DC 1879, diesel, which is rated 281 hp at 1200 rpm, with a Twin Disc clutch and De Lux oil filters installed in a Koehring dragline by Gulf Coast Engine Sales Inc. of Tampa.

FOUR cyl Waukesha 35 hp diesel engine powers the 10 kw generating set being used for night operations on the 6 yd. Manitowoc dragline at levee 5 W and levee 6 NE near pump station #7 of the

Skipper-Owner Rudolph B. Matland REPOWERS the *RUSH* with Another WAUKESHA

370



• The 73′ *Rush* of Fairhaven, Mass., is changing from scalloping to dragging. Captain Rudolph B. Matland is changing engines too—but just the model, not the make. He has had a 1905 cu. in. Waukesha Wanderer Diesel for five years. He knows Waukesha dependability. Now he's repowering with another Waukesha—installed by Hathaway Machinery Co.—a six-cylinder 8½ x 8½-in., 2894 cu. in. Defender Diesel that will give him up to 300 hp at 1000 rpm, all 24 hours of the day. Equipped with a Snow-Nabstedt 3:1 reduction gear and front power take-off, the Waukesha Defender Diesel will swing a new 60 x 48 5-blade Federal propeller. All Waukesha Marine Diesels are economical to run, easy to maintain, and upkeep is low.

Send for Bulletin 1691.

WAUKESHA MOTOR COMPANY
WAUKESHA • WISCONSIN
New York Tulsa Los Angeles

WAUKESHA MARINE *Diesels*

Normal or Turbocharged up to 990 hp for 24-hour duty

Central & Southern Florida Flood Control Project.

OVER at Fort Myers, the Fort Myers Shell Co. is using a TD#6 International crawler tractor with a 50 net hp International diesel engine in the oyster beds while the State Road Div. is using a similar tractor at the Sunshine Skyway Park for beach erosion work.

TWO Allis-Chalmers HD16 crawler tractors with dozer blades and powered with Allis-Chalmers HD844, 170 hp, diesel engines and hydraulic torque converter drives, are being used by Dunn Construction Co. on road work rebuilding and draining ditches at Bowlees Creek on the West Coast.

TAMPA Marine launched two 85 ft. utility and tow boats. Both the *San Lorenzo* and the *San Timote* are powered by two General Motors tandem 6-110 diesels rated 440 hp each. For auxiliary purposes each has two General Motors dieselized generating units with 30 kw 120/208 volt 60 cycle ac Delco generators; to be used by the Gulf Oil Co. in Venezula, S. A.

TROUP Construction Co. took delivery, from Shelly Tractor & Equipment Co., of a #955 1½ cu. yd. Traxcavator, a D8 tractor with torque converter drive and an 85 hp D6 tractor; all had Caterpillar diesel engines plus two DW 21 25 yd. scrapers drawn by 300 hp two wheel Caterpillar tractors.

UP at Pompano Beach, the E. A. Jones Farm took delivery of a General Motors 4030-C diesel engine with G. M. power take-off to be used for irrigation purposes. This 4 cyl 4¼ x 5 in. diesel is rated 98 hp at 1800 rpm.

WELLS Bros. of the Carolina Shrimp Co. selected model HRM-600 Cummins marine diesel engines with Twin Disc 3:1 r&r gears for their two new 62 foot shrimp trawlers being built at St. Augustine. These 4 cycle 6 cyl diesels have a bore and stroke of 5⅛ x 6 in. and develop up to 175 hp at 1800 rpm. They were supplied by Cummins Diesel Engines of Florida.

GENERAL Engine & Equipment Co. of Tampa supplied a 147 hp (6031 C) General Motors diesel with a high torque power take-off to the Mack Asphalt Co. of Lakeland for use in a D. S. 88 Cedarapids asphalt machine. Extra heavy duty air filters were included.

AT Homosassa, Leon Head repowered his 32 ft. charter fishing boat, the *Mystery*, with a model 6 DA 273 six cyl Allis-Chalmers diesel engine rated 76 hp at 2000 rpm and Capitol 2:1 r&r gears; from West Coast Engine Sales, Inc. of Tampa.

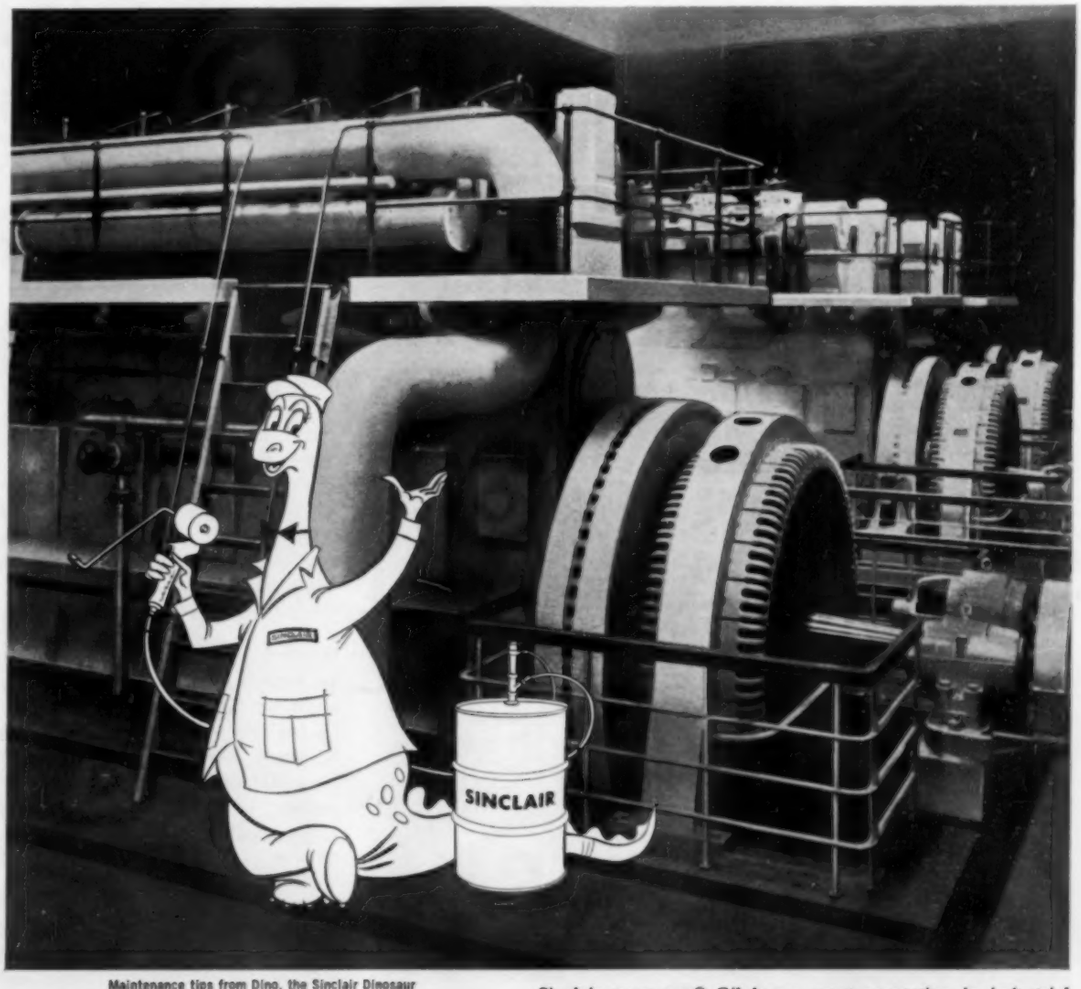
FLYING FISH, a twin screw 35 ft. party fishing boat at Clearwater, recently had installed, a 4 cyl Ford 68 hp marine diesel engine by Modern Diesel Power Company of Tampa with a 2:1 Capitol r&r gear. Its twin has 2:1 Paragon r&r gears.

Generator Bulletin

Engine-driven, low-speed synchronous generators of up to 450 rpm, which are particularly suitable for municipal power plants and industries' power needs, are described in General Electric Company's new bulletin GEA-5299B. The two-color, eight page bulletin is illustrated with examples of typical services performed by these motors which feature Polyex ground insulation systems and new constant-pressure brush holders. The bulletin GEA-5299B can be obtained from General Electric Company, 1 River Road, Schenectady 5, N. Y.

General Superintendent

L. E. Upton has been promoted to general superintendent of Dunlap Manufacturing Co., Tulsa. In his new capacity, Upton will be responsible for research and experimental design in industrial shutters and controls.



Maintenance tips from Dino, the Sinclair Dinosaur

NOW- less oil consumption

Sinclair RUBILENE® Oil has a great reputation in industrial Diesel applications – and for several good reasons. Engineers have found that Sinclair RUBILENE can cut oil consumption, reduce service time to a minimum. It prevents the formation of harmful carbon, sludge and varnish. It stands up under the highest operating temperatures, provides better lubrication protection to cylinders, pistons, rings and other vital moving parts.

Switch to Sinclair RUBILENE and lower your costs. Whatever the make or age of your Diesel, whatever your lubrication problem, there's a RUBILENE or RUBILENE HD Oil that should meet your requirements. Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.

SINCLAIR
RUBILENE OILS

Michigan-Ohio News

By **Jim Brown**

CONSTRUCTION contract totaling $10,127,000 has been awarded to Hoyle-Newberg and Gust K. Newberg Construction Companies, a joint venture, with offices in Chicago, by Colonel Peter C. Hyzer, Detroit District Engineer, Army Corps of Engineers for the construction of airfield pavements, lighting and fuel facilities at K. I. Sawyer Air Force Base in Marquette County, Mich.

PENINSULAR Diesel Inc. of Detroit has recently delivered three more trailer-mounted General Motors generator sets. These were delivered to Cook Contracting Co., of Centerline, Mich. (a 100 kw set powered by a GM 6150 Detroit Diesel for a Butler portable batching plant), Carl Goodwin & Son of Allegan, Mich. (an 80 kw set powered by a model 4150 GM Detroit Diesel for a Butler batching plant) and Spartan Asphalt Paving Co. of Detroit (245 kw set powered by a GM model 12205—Twin 6-71—for a portable asphalt plant).

WOLVERINE Tractor and Equipment Co. of Detroit and Grand Rapids has delivered two models T-500 Galion Graders powered by Cummins diesels to Midland County Road Commissioners.

NORTHWEST model 6 (1½-yd) shovel was recently sold by Cyril J. Burke, Inc. of Detroit to the Miller Thompson Co. of Detroit. The new Northwest is powered by a model 20 Murphy diesel engine.

LYLE and Dale Bush, excavators from Quincy, Mich. have accepted delivery on a new Allis-Chalmers model HD6B with hydraulic dozer blade. Sale was made by Earle Equipment Co. of Detroit.

GENTRY Tug Boat Lines of Detroit has accepted delivery on a model HRS-6-M Cummins diesel rated at 225 hp at 1800 rpm. The new engine will be installed in a 40 ft. tug, the *Captain F. Gentry*. Reverse gears are Twin Disc with ratio of 2 to 1. The engine was supplied by Cummins Diesel Michigan Inc. of Dearborn, Mich.

KUTCHINS Paving Co. of Detroit has accepted delivery on a model OC-4 Oliver crawler-tractor powered with an Oliver model 3D diesel engine. The new Oliver crawler is equipped with a hydraulic dozer blade and travel reverser transmission. It is rated at 24½ drawbar hp and weighs 6300 lbs with dozer blade. The crawler was purchased from Cyril J. Burke Co. of Detroit and will be broken in on a road-widening project in the Harper Woods area near Detroit.

NEW optional features have been developed on the Huber-Warco Maintainer, manufactured by the Huber-Warco Co. of Marion, Ohio. One of these features are large, over-size rear tires. By using new 18:00-26 rear tires the operator can achieve increased flotation and traction in sandy or loose soil. By filling the four tires with calcium chloride, the weight of the Maintainer can be increased by 2,880 lbs to a total of 9,520 lbs to increase traction. A 5 tooth scarifier is a second new optional feature now available for the H-W Maintainer. The scarifier has been engineered for maximum efficiency in medium and light duty scarifying operations.

PENINSULAR Diesel Inc. of Detroit has recently delivered two standby generator sets to General Telephone Co. One of these was delivered at the North Muskegon station—a 35 kw set powered by a GM Model 2150 Detroit Diesel engine. The other was delivered to the Muskegon Heights station—this one rated at 55 kw and powered by a GM model 3150 Detroit Diesel engine.

DROTT model TD-20 Power Tractor equipped with a Land Clearing Special was sold by Wolverine Tractor and Equipment Co. of Detroit. The model TD-20—a new one in the Drott-International equipment line—features an extra long track and is rated at 111 drawbar hp. This one was purchased by Charles Vaughn of Detroit.

GEORGE Tripp of Pontiac, Mich. has accepted delivery on a Northwest model 41 pull-shovel. The new shovel is equipped with a 1 yd bucket, is powered by a Murphy model 12 diesel engine and was sold by Cyril J. Burke, Inc. of Detroit.

AN Allis-Chalmers model D grader was recently sold by the Earle Equipment Co. of Detroit. The new grader will be broken in by A. Salvatore on a highway construction project at St. Clair Shores, Mich.

MICHIGAN State University has accepted delivery on a model HR-6-I-TC Cummins diesel torgue converter unit rated at 175 hp at 1800 rpm. This unit will be used in an American Locomotive crane with a Twin Disc model F10029 torque converter. The crane will be used for loading and unloading coal cars and for spotting cars. The sale was made by Cummins Diesel Michigan Inc.

KUTCHINS Paving Co. of Detroit has accepted delivery of a Bros model SP 54 Roller powered by a Hercules diesel engine. The roller was sold by Cyril J. Burke Inc. of Detroit.

DELONG Bulldozing Co. of Muskegon, Mich. has repowered their Wayne model 66 crane with a GM model 2055 Detroit Diesel engine. The engine was supplied by Peninsular Diesel Inc. of Detroit.

WOLVERINE Tractor and Equipment Co. of Detroit and Grand Rapids has recently sold a model 22-D Bucyrus-Erie shovel equipped with an International UD 525 diesel engine to the Missaukee County Road Commission of Lake City, Mich.

UPJOHN Co., a pharmaceutical company located in Kalamazoo, Mich. has accepted delivery on a Cummins model H-6-BI for installation in a G.E. 25 ton locomotive. The sale was made by Cummins Diesel Michigan Inc. of Dearborn, Mich.

EARLE Equipment Company of Detroit has delivered a model HD6G Allis Chalmers with Tracto Loader to William Eddy, an excavator from Ann Arbor, Michigan.

NORTHWEST model 95 dragline equipped with a 2½-yd Page bucket is being broken in on the Edsel Ford Expressway in Detroit by Charles Rogers, also of Detroit. The Northwest is powered by a Murphy 21 diesel engine and was purchased from Cyril J. Burke Inc. of Detroit.

Buys 24 Buses

Sale of 24 transit type buses to the Connecticut Co., of New Haven, has been announced by Mack Trucks, Inc. They will be placed in service in the Greater Hartford area. The buses will be of 51-passenger capacity and will provide special comfort features including Mack's air suspension system, extra-wide aisles, high head room and thermostatically controlled heating systems. They will be powered by Mack's Thermodyne diesel engines. The Connecticut Company operates a fleet of 550 buses in the Connecticut communities of Stamford, New Haven, Meriden, Middletown, Norwalk, New London and the Greater Hartford area.

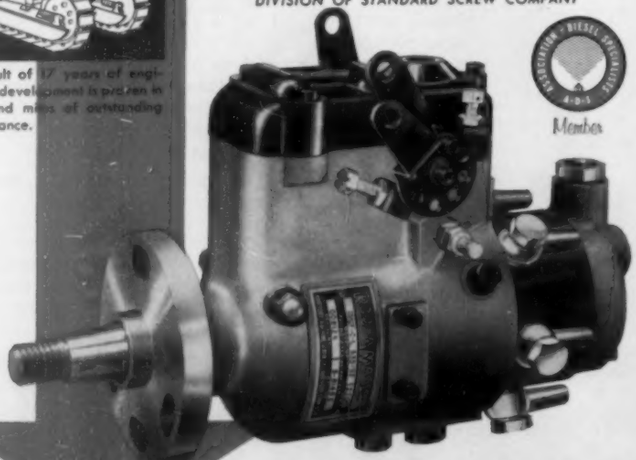
lower initial cost
lower service cost

Compare and you will see the ROOSA MASTER fuel injection pump costs less. Use it and you will see that your service costs less. There are fewer parts to service and repair because of the unique design of ROOSA MASTER. It takes less space on your engine, and weighs less than 10 pounds. Even though small in size and light in weight one size serves either a 2, 3, 4, 6 or 8 cylinder engine.

HMS ROOSA MASTER makes good diesels better

HARTFORD MACHINE SCREW CO., HARTFORD 2, CONN.
DIVISION OF STANDARD SCREW COMPANY

The result of 17 years of engineering development is proven in hours and miles of outstanding performance.



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YOU CAN DEPEND ON THE DIESEL THAT DEPENDS ON ROOSA MASTER

Inland River Reports

By A. D. Burroughs

NEW inland river vessels, new power, new names, new tow products, new industries turning to the waterway transportation add up to new enthusiasm for the diesel industry along all inland rivers.

AN Allis-Chalmers engine, furnished by Mechanical Equipment Co., New Orleans supplies 200 hp for the new single screw tug, *Cathy Cenac*. The 55 by 17 ft. craft, now in coastwise trade for owners Cenac Towing Co., Inc., Houma, La., was delivered by builders, Main Iron Works.

GEORGE Engine Co., Harvey, La., supplied the GM (Detroit) series 110 engines, rated at 300 hp each at 1800 rpm for the brand new tug, *Randy*. Built by Harvey Canal Shipyard for owners, Fifty Marine Service, the 48 by 17½ ft. tug works on the Atchafalaya, Ouachita, Red, Mississippi and Gulf waters.

ANOTHER new addition to the River-Gulf traffic is the big, beautiful 103 ft. tug, *Margaret C* with 1200 hp provided by GM Cleveland engines, model 12-567. Built by Gulfport Shipbuilding Corp., owned by Continental Casualty Co., and chartered by A. L. Mechling Barge Lines, Inc., the tug joins a fleet of 14 towboats, two seagoing tugs, and 187 barges.

FAIRBANKS-Morse model F-5¼-M OP engines, each rated at 600 hp at 1200 rpm, will power the 90 x 26 ft towboat under construction at St. Louis Shipbuilding and Steel Corp., for owners Mid-America Transportation Co. Yet un-named, the craft will be similar to the *J. W. Rose*. Delivery is scheduled for early fall.

FERRY fans cheer the *Pam*, new diesel towboat in service from Clarington, Ohio to the W. Virginia shores. Built by Yates Marine Construction, Wheeling, for R. E. Ruble, the 50 by 10 ft. all-steel boat operates 20 hrs a day, powered by a GM turning a single screw.

ANOTHER new diesel-powered passenger vessel is the 70 by 25 ft. *Mackinac Islander*, recently delivered by builder Hans Hansen Welding Co., Toledo, Ohio to Arnold Transit Co., Michigan. The all-steel welded craft carries 250 passengers, plus a crew of six, in addition to normal freight loads with push power from a 360 hp Kahlenberg engine.

LITTLE JULE, 35 x 10 ft. one-man tender is in service for Luhr Bros., Inc., Columbia, Ill. Delivered by Humboldt Boat Service, St. Louis, power comes from a GM (Detroit) 6-71.

SIGHTED the U.S. Engineers new Mississippi River patrolboat, *Lipscomb*, turning in a fine power performance from two 800 hp turbo-charged White Superior engines. The 125 x 32 ft. vessel, delivered by Arnold V. Walker yard, is the replacement for the steamer, *Charles H. West*.

HUTCHINSON Barge Line's towboat, *Larry Turner* hit headlines proving the point of diesel push power with the mammouth tow of the LST naval craft. The 124 ft. Turner pushed the 442 ft. LST with power from GM engines with a total rating of 1800 hp.

WE watched the new *Maple* near our own home port. The 50 x 16 ft. utility boat built by Maxon Construction Co., Tell City, Ind., is a single screw design, powered by an individual type GM (Detroit) 610, 220 hp.

KOHLER generating set heads the excellent equipment listing for the new towboat, *Omal*. The 53 x 20 ft. craft, delivered by Barbour Metal Boat Works to Potts and Potts Towing, Sardis, Ohio, has 450 hp developed from two GM 6-110's.

ANOTHER recent delivery from the busy Barbour yard St. Louis, went to Burnside, La. The all-steel 440 hp towboat, named the *No. 10* was equipped with twin GM (Detroit) 6-110's.

HUMBOLDT Boat Service, St. Louis, has received the order from Dairyland Power Co-operative, LaCrosse, Wis., for a 300 hp utility boat. Plans call for original installation of twin GM Model 6-71's, with design adaptable for later installation of GM 6-110's. The craft will see service at the owner's riverside generating plant.

C. V. HARNER is the new name for the old favorite, *R. H. Bosworth*. Sold by Point Towing Co., to the new company, Elk Towing, the two White Superior engines will supply 580 hp. A third engine has been installed, a GM, to boost the power total to 790 hp.

ACTIVE on the Upper Ohio River was the faithful *Raymond E. Salvati*, serving the Island Creek Co. with power from two Enterprise engines rated 2560 hp total.

THE *A. D. Haynes II* was another active towboat, working for MVBL. The 200 ft. craft has a good work record, with power from two Nordberg Supairthermal V-12 engines, rated conservatively at 4200 hp.

HAWKEYE, in steady service for Midwest Towing, was spotted with a good-sized tow, using power developed from two Cooper-Bessemer JS-8-T engines of 1240 hp each. This 1957 edition from St. Louis Ship carries Ross lube oil coolers, Wartenbe filters, and Kahlenberg horn.

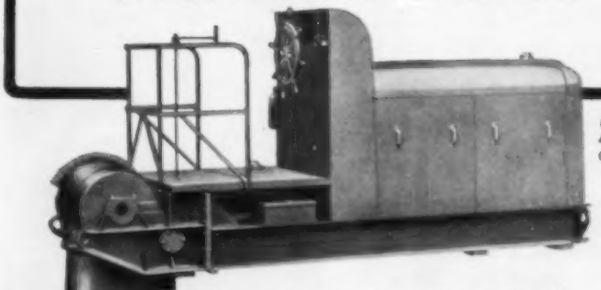
SPECIAL expression of thanks to the reader sending the engine room photo of the practical towboat, the *Bob Benter*. The 11th towboat of the Ohio River Company's series measures 140 ft., and carries power from the two Baldwin-Lima-Hamilton engines.

QUAKER STATE, on the waterways for the Crain fleet duty, made good time with power from two Cat engines. The unique pilothouse gives this towboat its unmistakable appearance.

Houdaille Acquires Canadian Firm

Ralph F. Peo, Board Chairman and President of Houdaille Industries, Inc., Buffalo, N.Y., has announced that his company has completed negotiations and is purchasing for cash, all of the capital stock of one of Canada's most important engineering and manufacturing industries, Provincial Engineering Ltd. of Niagara Falls, Ontario. Probably the largest manufacturer of cranes in Canada, this company offers overhead materials handling equipment in capacities from ½ ton to 450 ton, with many exclusive and specialized designs particularly adapted to the mining, iron and steel and pulp and paper and maritime industries. The Transmission Tower Division is looked upon as one of the most modern manufacturing plants of its type in North America, and is probably the Dominion's largest supplier of this type of equipment in the power transmission field. In the Engineering and Construction Division, Provincial Engineering specializes in the design and construction of ready-to-operate manufacturing plants, particularly for the chemical, paper, mining and cement industries. For example, Provincial Engineering is currently engaged in a 25 million dollar paper mill project in East Pakistan.

Harbormaster Outboard Propulsion and Steering Units move bigger payloads in less time and at less cost



Models from 40 to 400 h.p. Gas or Diesel

Harbormasters permit simplified hull design, more cargo space, bigger payloads, and more efficient crew operation. Outboard propulsion eliminates deadwood, stuffing boxes and rudder drag, and makes possible the use of a larger propeller, located farther aft of the hull. The result is more actual delivered thrust per H.P. than the same engine with an inboard system.

The advantages of Harbormaster Outboard Propulsion and Steering have been proved in better running speeds, shorter trip times, and greater payloads in hundreds of installations.

Harbormasters are rugged and powerful. They are a complete package . . . quick and easy to install on new or existing craft.

Complete 360 degree maneuverability. Steer effectively in any direction with full power.

Special elevating mechanism allows one-man operator to raise entire submerged assembly.

Shear pin lets tail section ride up and over any submerged obstacle, protecting it from damage.

Send for catalog which illustrates and describes in detail all the advantages of Harbormaster Outboard Propulsion and Steering.

MURRAY & TREGURTHA, INC.
QUINCY 71, MASSACHUSETTS

MURRAY & TREGURTHA, INC.
6 Hancock St., Quincy 71, Mass.

Please send me New Catalog giving details and showing many photos of Harbormasters in action.

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Company.....

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.....

Gulf Coast Diesel Notes

By **Michael T. Pate**

W. E. WILHELM, Santurce, Puerto Rico, has taken delivery of a Stewart & Stevenson model 6GD-66 60 kw, ac generating set with automatic control to be used as stand-by power for a Navy frozen food locker plant. The unit is powered by a 6 cyl. General Motors diesel, model 6030-C. The sale was made by Stewart & Stevenson Services, Inc., Houston.

R. BENTON ROSS Drilling Company, Wichita Falls, Tex. has purchased from Atlas Power, Inc., of Wichita Falls, a 6DA-844 Allis-Chalmers diesel power unit which will be connected to a 7¼ x 10 Gardner-Denver mud pump.

BAROID Division, National Lead Company, Houston, Tex. has bought from Stewart & Stevenson Services, Inc., of Houston, two 6-cyl., series 71, model 6030-C open type General Motors diesels, each rated at 180 hp. The company also took delivery of two 4-cyl., series 71, model 4030-C diesels, rated at 100 hp each. The four diesels will be used to drive all equipment aboard a mud barge for serving offshore drilling rigs.

GULFPORT Shipyard, Port Arthur, Tex. has taken delivery of a series 71, model 6055, 6-cyl. bare engine type diesel. The General Motors unit was sold by Stewart & Stevenson Services, Inc., Houston.

EQUIPMENT Service Company, Pecos, Tex. has purchased from Waukesha Sales & Service, Houston, a model 6WAKD-BSU Waukesha diesel, rated 352 hp at 1600 rpm. The diesel will be used to power a test unit for proving water-well pumps.

HAYES Aircraft Company, Birmingham, Ala. has taken delivery from Stewart & Stevenson Services, Inc., Houston, of two Stewart & Stevenson special 45 kw generating sets, each powered by a General Motors series 71, model 3030-C, 3 cyl. diesel.

CHICAGO Procurement Office, Corps of Engineers, U.S. Army, Chicago, Ill. has been delivered 81 additional Stewart & Stevenson special 45 kw, ac generating sets, each powered by a 3 cyl. series 71, model 3030-C General Motors diesel.

L. T. BURNS Estate, Wichita Falls, Tex. has had Atlas Power, Inc., of Wichita Falls, prepare for operation a shipment of 14 model 6BD-230 Allis-Chalmers diesels, which will be used to power water pumps, light plants and lubricators on the estate. The diesels are rated 38 hp each, maximum, at 1200 rpm.

ASIATIC Petroleum Corporation, Export Division, New York City, has bought eight Stewart & Stevenson special explosion resistant 6 kw, ac generating units, each powered by a 2 cyl. model AVA2 Petter air-cooled diesel.

SUPERIOR Oil Company, Lake Arthur, La., has bought from Stewart & Stevenson Services, Inc., of Houston, a 2 cyl. series 71, model 2031-C General Motors diesel, rated at 50 hp.

GARDNER-Denver Company, Dallas, has bought from Waukesha Sales & Service, Inc., of Houston, a model 135DKU Waukesha diesel, rated 106 hp at 1800 rpm. The diesel will be unitized with a G-D pump.

MINAGRO Industriale, S. A., Havana, Cuba, has bought from Stewart & Stevenson Services, Inc., of Houston, a 6 cyl. horizontal-type, series 71, model 6055 General Motors diesel. The company also took delivery of a vertical diesel of the same model. Diesels are rated 180 hp.

ANNOUNCING A MILESTONE
NEW DELCO-REMY A.C. GENERATOR WITH BUILT-IN RECTIFIERS
PROGRESSIVE ENGINEERING MAKES THE DIFFERENCE
NEW DELCO-REMY TRANSISTOR VOLTAGE REGULATOR WITH NO MOVING PARTS

Midwest Diesel News

By L. H. Houck

CHUCK Hansen, Storm Lake, Ia., has taken delivery of a 923F Diamond T with 180 hp Cummins, 5C720 Fuller transmission and Eaton 18803 driving axle, with 10:00x20 rear tires, from Sioux City Truck Sales, Inc., Sioux City, Ia.

LINCOLN County Highway Dept., Merrill, Wis., has repowered an Oshkosh W-703 with a 175 hp JT-6-B Cummins from Cummins Diesel Sales Corp., Hibbing, Minn.

FOUR Kenworth 8 cu. yd. end dumps to Utah Construction Co., for use in their Wyoming operation near Riverton. Models are L-924, engines NTO-6-B Cummins, Heil bodies, Timkin driving axles, Spicer 10-speed transmissions and Spicer manual clutch. The Kenworth fleet on this job now numbers 14.

MACK H67T COE to Earl Holbrook, Yankton, S. D., with Mack B-61 Thermodyne diesel, 15 speed Mack transmission, with 10:00x20 rear tires, from Sioux City Truck Sales, Inc., Sioux City, Ia.

OWENS Produce Co., Bentonville, Ark., is using Mack B-61 Thermodynes, 170 hp diesel tractors in its fruit and vegetable service. Tractors have 10-sp. Mack transmissions and 10:00x20 rear duals.

DENVER—Chicago Trucking Co., recently added 13 Kenworth No. 525's, COE with tilt cabs and sleepers to its diesel fleet. Engines are Cummins.

UTAH Construction Co. has placed a model 480 Michigan dozer in service on its Riverton, Wyo., job. It has 600 diesel hp by Cummins. This huge machine is made by Clark Equipment Co.

JACK Walters, Sioux City, Ia., bought a Diamond T with Cummins 180 hp from Sioux City Truck Sales, Inc. It's a Model T-923, COE, has Fuller Road-Ranger transmission and Eaton driving axle with 10:00x20 tires.

IVAN Dement Inc., Amarillo, Texas, has added a Caterpillar D9 with Twin Disc torque converter to its fleet of tractors and Caterpillar DW-21 scrapers.

RAYMOND Moores, Beech Grove, Indiana, has repowered an Autocar DC-75-T with a 190 hp Cummins from Cummins Diesel Sales Corp., Indianapolis.

CATERPILLAR D8 with Twin Disc torque converter from Wortham Machinery Co., Cheyenne, to Pacific Power & Light Co., Glen Rock, Wyo.

CATERPILLAR electric generator set, a 353, to D. W. Hopkins, Wheatland, Wyo., for powering a hot mix plant.

MACK B-61 Thermodyne diesel to Ted Vandenhul, Alton, Ia. with Mack 10 speed transmission.

PORTABLE power on a trailer for powering a Cedar Rapids crusher has been developed by D. W. Hopkins, Wheatland, Wyo. Engine is a D-337-F Caterpillar diesel, with a Cotta transmission and speed reducer connected to a jack shaft, which connects to the crusher through a universal joint.

EDWARD Reynolds, Indianapolis, has repowered an International DCO-F-405 with a Cummins HRF 190 hp from Cummins Diesel Sales in Indianapolis.

HUNTLEY Construction Co., Rock Springs, Wyo., now has three S-12 Euclids in use on road construction. They are powered with 6-71 GM 2-cycle, 218 hp. engines and haul 17 cu. yds. heaped.

NEW power for a Barber-Greene paver owned by Read Construction Co., Cheyenne, Wyo., is a Caterpillar 326 from Wortham Machinery Co.

IN AUTOMOTIVE ELECTRICITY

—DELCO-REMY'S NEW GOLDEN MILESTONE SELF-RECTIFYING A.C. GENERATOR WITH TRANSISTOR REGULATOR

Progressive engineering at Delco-Remy has produced the most significant development in automotive electricity in two decades—the revolutionary new *golden milestone* self-rectifying a.c. generator and its companion all-new transistor regulator. This trend-setting new power team is designed specifically to meet the extra output requirements of *future* cars and trucks—beginning with 1959 models.

The compact new generator with its specially developed built-in silicon rectifiers can be installed quickly and easily with a minimum of change in standard d.c. electrical systems . . . offers a heavy charge at engine idle and up to *twice* the total output—with only a small increase in weight.

Delco-Remy's unique transistor regulator represents a bold new concept in voltage regulation—an electronic unit composed of durable long-lasting transistors and diodes *with no moving parts*. There are no mechanical components such as springs, hinges and contacts, so mounting position and vibration have no effect on operation, and the usual adverse effects of temperature and humidity are nullified. To the user, this means long-lasting settings, more accurate control of generator voltage, and elimination of periodic maintenance.

The Golden Milestone Power Team is an outstanding example of Delco-Remy engineering leadership in the automotive electrical field—of Progressive Engineering at work for you.

GM GENERAL MOTORS LEADS THE WAY—STARTING WITH Delco-Remy ELECTRICAL SYSTEMS

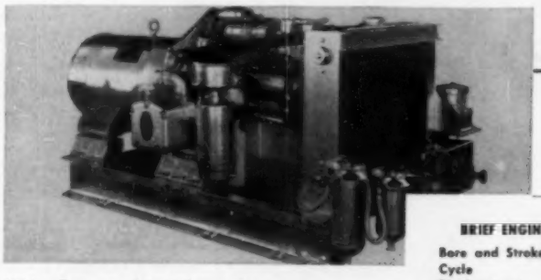
DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

WITTE MODEL 100RDA

A Diesel Engine-Generator Unit
12KW (Continuous)—1800 RPM

This powerful, compact, diesel engine-generator unit is setting outstanding performance records in maintaining either low (–10°F) or high (70°F) temperature in 50' mechanically refrigerated railway cars.

Many other uses are being found for the Witte 100 Engine, which powers this unit. Its low profile (30") makes it desirable in either stationary or mobile applications. Its two horizontally opposed cylinders provide an unusually smooth, vibration-free unit. The 100 Engine is built for continuous 24-hour-a-day operation and is outstanding in heavy-duty industrial applications.



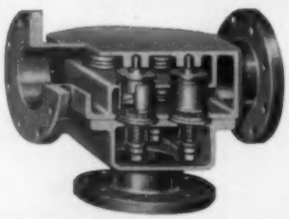
Write for complete information . . .

BRIEF ENGINE SPECIFICATIONS

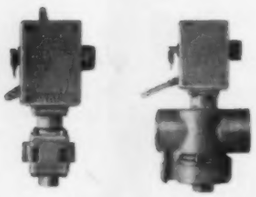
Bore and Stroke	4" x 4"
Cycle	4
Displacement	100 cu. in.
Speed	1,800 rpm
Horsepower:	
Continuous	18 hp
Maximum (Bore Engine)	23.7 hp
Height	30"
Width	39"
Length (Approx.)	66"

Witte Engine Works
Oil Well Supply Division of
United States Steel
1615 Oakland Ave.—Kansas City 26, Mo.

AMOT ENGINE CONTROLS

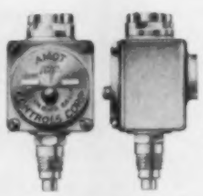


THERMOSTATIC VALVES, for jacket water and lube oil temperature control. Self contained, modulating, use no external bulbs. Sizes 1½" to 6". Temperature settings 75°F to 195°F.



MECHANICAL SAFETY CONTROL VALVES, used to shut down engines and compressors in event of oil pressure failure, overspeed, overheating of jacket water or lube oil, etc.

VENTED GAS VALVE, diaphragm operated will shut off the fuel gas and vent the manifold when used on internal combustion engine applications. Made in 2", 3" and 4" sizes.



SAFETY CONTROL SWITCH will flash warning signal, sound an alarm or close a solenoid fuel valve on overheating of jacket water or lube oil, or pressure failure of lubricating system.

AMOT CONTROLS CORPORATION • FIRST ST. & NEVIN AVE. RICHMOND, CALIFORNIA

Name General Manager Of Worthington Division

George Steven

George Steven has been named General Manager of the Compressor & Engine Division of Worthington Corporation at Buffalo, N.Y. announces E. J. Tribble, the corporation's Group Vice President. Formerly Assistant General Manager at the Buffalo Division, Steven assumed his new post on August 1. He replaces Vice President Austin C. Ross who retired the end of July after serving the corporation for 26 years in key purchasing, manufacturing and managerial positions. A graduate of the Royal Technical College, Glasgow, Scotland, Steven joined Worthington at the Cincinnati Works in 1923. In 1932 he was transferred to the Buffalo Division where he served successively as Assistant Chief Engineer-Compressors, Chief Engineer-Compressors, and Manager of Engineering prior to his appointment in January 1958 as Assistant General Manager. Mr. Steven is a licensed professional engineer in New York State, a member of the American Gas Association, American Society of Mechanical Engineers, Southern Gas Association, and a past president of the Erie County chapter of the New York State Society of Professional Engineers.

New Advertising Manager at Nordberg

Edward L. Satola

Appointment of Edward L. Satola as Advertising Manager is announced by Robert E. Friend, President, Nordberg Manufacturing Company, Milwaukee, Wisconsin. Mr. Satola has served on the Nordberg advertising staff in various capacities for six years. During his advertising career, he was an account executive at Klau, Van Pietersom, Dunlap, Inc., advertising agency. Mr. Satola is a graduate of Fenn College, Cleveland, Ohio, where he studied mechanical engineering and won his degree in Business Administration. He is also a graduate of a four year apprenticeship at the Warner & Swasey Company, Cleveland.

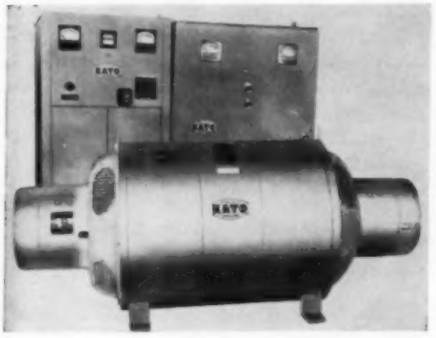
Appointed Sales Manager

Kenneth C. Gerhardt

Kenneth C. Gerhardt has been named Sales Manager of the Test Equipment Division of Consolidated Diesel Electric Corporation, it was announced recently by Louis B. Haberman, General Manager of the Division. Mr. Gerhardt joined Con Diesel in May of 1955 as a sales engineer from the sales department of Greer Hydraulics, Inc. He has a Bachelor of Mechanical Engineering degree from the Polytechnic Institute of Brooklyn.

Improved Generator Control Panels

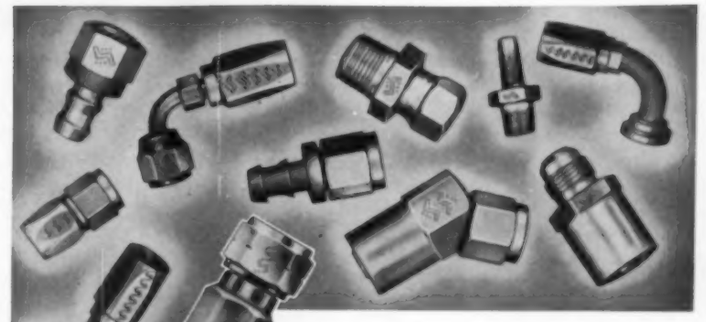
Improved methods of generator control panel fabrication have resulted in reduced costs and subsequent customer savings, according to the manufacturer, Kato Engineering Company, Mankato, Minnesota, Department 21A. The control panels, in three basic designs—generator mounted, wall mounted, or floor mounted—are supplied with ac and dc generators, motors, and motor-generator sets which the company manufactures



from 500 watts to 800 kw ac output. Illustrated are typical twin floor mounted cubicals supplied with a 40 kw motor-generator set which changes 60 cycle, 3 phase, ac current to 400 cycle ac. At left is the generator control unit with voltmeter, frequency meter, ammeter, selector switch, and voltage adjust rheostat for the automatic voltage regulator. With this automatic control voltage regulation is kept to within one-half of one per cent. Maximum voltage dip and overshoot is seven per cent. The motor starter cubical at right contains input ammeter and motor field ammeter and the synchronous motor starter.

New 6,000 Pound Lift Truck

A new 6,000 pound capacity Lull (LD-600) fork lift truck designed for operating over rough terrain and handling high lift operations has been introduced by Lull Engineering Company, St. Paul, Minn. The new truck features four-wheel drive, power steering, power booster brakes and tilting telescopic tower. It is powered by a Hercules model DD-298 six cylinder diesel engine, which develops 85 hp at 2,000 rpm, and has a full reversing shuttle transmission. ITS NEW



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Made in a wide variety of sizes and types for hundreds of commercial and industrial uses, Stratoflex detachable and reusable fittings simplify maintenance and assure leak-proof connections under extreme temperature variations. Stratoflex hose provides the flexibility, small bend radii and durability essential for dependable service.

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Plans Major Plant Addition

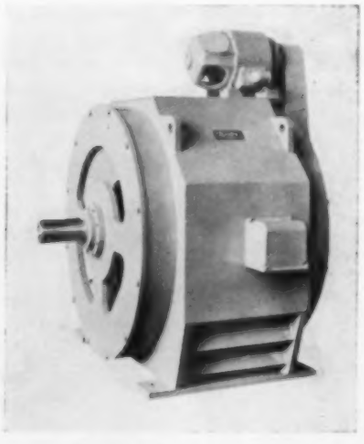
Cummins Engine Company, Inc., Columbus, Indiana, has announced plans for construction of a major addition to its manufacturing plant with construction to start late in 1958. The new facilities, to cost in excess of $6,000,000 including equipment, will provide about 300,000 sq. ft. of additional floor space, an increase of 38 per cent, and will be the largest single building on the present site. It will include new engine test cells, additional space for the assembly of marine engines, diesel-electric generating sets, power units, and adequate export boxing areas and shipping docks. The new facilities will also include an additional power house. The expansion, in addition to expenditures for other new machinery and facilities, will bring total capital expenditures for the year 1958 to more than $12,000,000.

In connection with this announcement, R. E. Huthsteiner, President of the Indiana diesel manufacturing firm, said, "The production of Cummins engines during the first six months of 1958 has been at the highest sustained level in the 40 year history of the company, and the recent introduction of two new models for medium-heavy duty trucks and the engineering of Cummins power into over 100 additional models of construction equipment during the past two years have necessitated this increase in facilities." Final sales figures released in March 1958 showed that Cummins' net sales for 1957 were approximately $111,200,000, or five per cent greater than the record sales of 1956.

With the completion of these new facilities, the Company and its wholly-owned subsidiaries will have spent over $42,000,000 on new machinery and facilities since 1950. Some major aspects of this program have included the establishing of an engine manufacturing plant in Shotts, Lanarkshire, Scotland in 1956, the purchase of Atlas Crankshaft, Inc., Fostoria, Ohio, early this year, and expansion of the Cummins Research Laboratory completed in 1955.

Increase Ratings of Columbia Generators

Announcement is made by Columbia Electric Mfg. Co., Cleveland 14, Ohio of its new Frame 5200 series synchronous generators now available in 900 rpm ratings through 1250 kva, 0.8 pf, 1000 kw, three phase, 60 cycles (and equivalent 50 cycle ratings) in all standard voltages through 6600 volts. This new and larger frame, designed for ease of maintenance, has rigid bracket bearing construction, featuring ball bearings, integral lifting lugs, all welded steel dripproof construction, baffled ventilating system, full damper (amortisseur) winding, well insulated layer wound field coils, class A or class B insulation as specified. Generators can be supplied for engine drive, either as two ball bearing units or single bearing with straight shaft or forged flanged shaft as required. A choice of special saturated direct connected or top mounted V-belt driven drip-proof exciters is offered. Generators and exciters liberally comply with NEMA Standards MG-1—1955 and ASA-C50.



600 kw, 2400 volt, 3 ph., 60 cyc., 900 rpm, two bearing Columbia ac generator with 5 kw top mounted exciter.

Columbia also manufactures dc generators up through 300 kw in addition to standard and low voltage motor generator sets. (ITS NEW)

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Canadian Distributors:
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A.P. 817

PORTABLE POWER FOR TRENTON

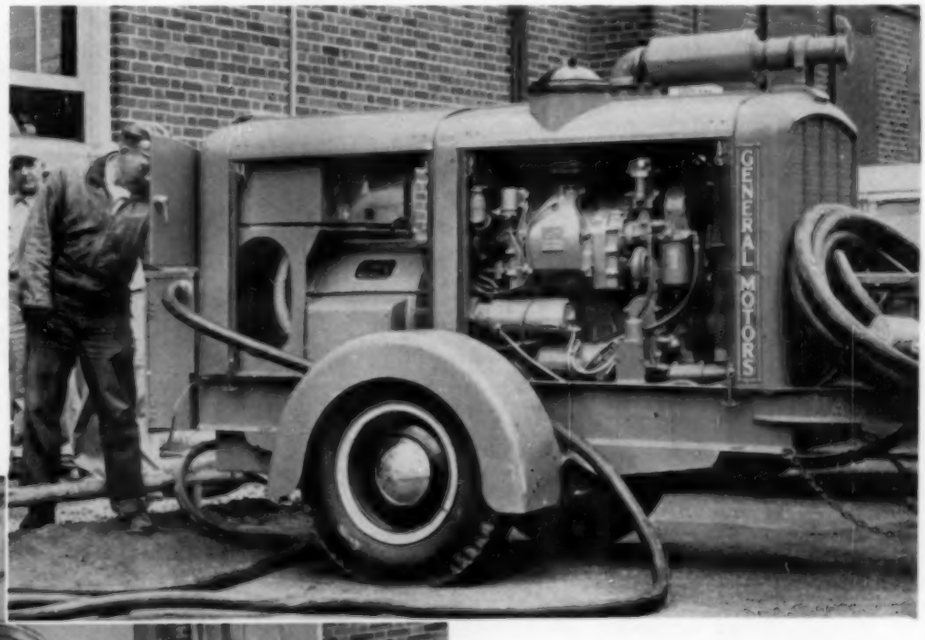
TRENTON, Michigan, like most communities with an eye on future growth, is ever alert to new ways of safeguarding the comfort and security of its residents in time of emergencies. A case in point is the recent response of Trenton's civic leaders to the need of standby power in its storm sewer system in the eastern half of the city. Standby power would insure the continued operation of electric lift pumps under all emergency conditions.

The need for standby power is emphasized by certain terrain features in the eastern area of Trenton which place the brunt of rainstorms almost 100 percent on the storm sewer system. Facing the Detroit River the area is mostly flat with no natural drainage to the river. Heavy clays comprise much of the subsoil limiting any great amount of absorption by the ground. Wide spread rock formations close to the earth's surface limit the degree of slope which can be built into the system and lift stations are vital during storms to move sewage over connecting links of the system to outlets on the river.

Action on the matter reached a satisfactory end late in April when city officials took delivery of a unique portable generator set capable of meeting the emergency requirements of any one of the three outlying lift stations within the system. The unit makes Trenton one of the few Michigan cities prepared with this type of equipment. City officials are also considering the use of the generator for other emergencies such as lighting temporary hospital facilities and supplying power for communications. Special wiring is already installed at Trenton's department of public works building which has been designated by civil defense officials as a temporary hospital for the Trenton area in time of emergency and the administration building which houses both police and fire departments.

The specially designed set, mounted on a two-wheel trailer, consists of a four cylinder General Motors 4-71 diesel engine driving an 80 kw generator (100 kva at .8 power factor; 60 cycle; 208/240 volts). Recent tests before city officials demonstrated the speed and simplicity with which the unit can be hooked up in the face of mainline power interruptions. First it is towed to the emergency point by any one of several city vehicles of ¾ ton capacity and up. On location it is connected to the load by two lead cables fitted with quick-fastening plugs. Since the engine has push-button starting and needs no warm-up period, power can be generated the instant cables are connected and a two-way switch is thrown from main line to standby power. Conveniently placed receptacles at the designated lift stations and city buildings further reduce connecting time.

Lead cables measure 75 ft each. Engine starting is by battery. Fuel for 12 hours full-load operation is carried in a 45-gallon tank located beneath the engine on the trailer frame. The trailer has an adjustable third wheel on the front and a closed-ring hitch which simplifies the job of getting the unit on the road. The unit was designed and built by Peninsular Diesel, Inc., of Detroit, GM diesel distributor in Michigan. Plans are being made which will lead to still broader utilization of the generator set. The city council has already approved mounting flood and spot lights on the unit for rescue work along Trenton's four-mile river front.



Trenton's new standby power unit consists of an 80 kw generator powered by a four cylinder GM 4-71 diesel engine. The unit has push button starting and power can be generated the instant cables are connected to the "load".

City officials of Trenton, Michigan, are briefed on the operation of the new standby generator during tryout tests at the city's municipal building. Left to right are C. B. (Chuck) Rossow of Peninsular Diesel, Inc.; C. T. (Cam) Walldorf, Fire Chief; Earl Henegar, Police Chief; and Charles Knopes, Superintendent, Dept. of Public Works.

Diesels All Around The World

By **F. Hal Higgins**

FIVE Alco 16-cyl. model 250 diesel engines furnish the pumping and electric power to put crude oil in waiting tankers at El Palito, Venezuela. The turbo-charged engines are designed for dual-fuel operation but are running on the crude from the wells they service.

ISBELL Construction Co., Reno, Nevada has a spectacular spread of diesel-powered road building equipment on a job 6.3 miles east of Sparks on Highway 40 where he is moving 1,600,000 cu. yds. Half a million yards of this is rock. Northwest 80D shovels powered by Murphy engines supplement the heavy work of the Bucyrus-Erie 110 B diesel electric shovel that was supplied electric power from a Cat diesel electric mobile unit.

NEW portable rotary drill rig by George E. Failing Co. is powered by two GMC diesels. The Crane Carrier truck has a 4-71 and the LeRoi 100-S2 compressor is powered by a 6031-C diesel.

MERCEDES-BENZ MB 836Bb diesel is now available in the U.S. via the Utica division of Curtis-Wright Corp. It is a light weight 6 cyl. four cycle liquid cooled engine with a compression ratio of 16:1. Bosch injection pumps are used.

ONAN Vacu-Flo cooling system is found on Onan's new 3,000 w diesel electric generating plant. This cooling system enables the plant to be installed in enclosed compartments only slightly larger than the unit.

CUMMINS engine of 240 hp powers the latest model scraper from the Wooldridge Div. of Continental Copper & Steel Industries. The new model is rated at a 31 mph speed with 15 yd struck load.

HERCULES has announced two new small 3 cyl. diesel engines. The series DD is direct injection; the series GO is overhead valve. Each is offered in two sizes of 16.9 and 19.2 NACC horsepower. These small engines are aimed to replace many small auxiliary gas engines used on concrete mixers, pumps, etc.

DALE Electric (Yorkshire) Ltd. has brought out the Dale Electric generating plant powered by the lightweight Drayton diesel single cylinder, air-cooled two cycle of 5.5 bhp at 1500 rpm. This unit provides a power-weight ratio 16.6 lb/bhp. It is available for stationary, portable and mobile service.

SEAMAN-GUNNISON is increasing its line of road and street construction equipment by taking the Interational tractors as prime movers and hanging on the rear utility scraper, a Duo-Pactor, Duo-Grader and Duo-Scraper. The International 350 in gas and the same company's 450 and 650 in diesel are used in this line. This Milwaukee firm has added something new in sheepsfoot rollcr in an interchangeable tire on the two tractor wheels for initial compaction in cloddy and sticky materials.

AMERICAN Hoist, pioneer in adapting diesel power to its cranes, has set a GM 3030C engine in its American 375 backhoe of ¾ yd size. It chose a Cummins for its Errectors hoist, and a Cat D-326F in its American 750 dragline of 2 yd capacity. The engine in its American diesel electric locomotive crane also drives a generator for electric power to the trucks. GM powers both the 840 and 850 models.

MOTORI Baltea, Torino, Italy, inform me they are now offering four air-cooled and one water-cooled diesel in a range from 6.5 to 18 hp. Its Baltea diesel engines are finding a market as auxiliary

Built as a bulk cargo carrier in 1903, M/V LAKEWOOD was converted to a sand barge in 1928. Owned by the Presque Isle Transportation Co. and operated by the Erie Sand Steamship Co.

M/V LAKEWOOD converted from steam to

CLEVELAND DIESEL POWER

Veteran of more than 50 years on the Great Lakes, the 377-foot M/V LAKEWOOD fills her holds with 4,000 cubic yards of sand in 8 to 8½ hours—and makes runs to Lake Erie ports at 12 miles an hour. Sand is dredged from a maximum depth of 65 feet and at a distance of 20 miles from shore.

Completely converted from steam to Diesel power at the yard of Erie Sand Steamship Company, Erie, Pa., she has an 800-h.p. Cleveland Diesel on the dredge pump and a 1,600-s.h.p. Cleveland Diesel, direct-connected to a Wichita clutch for main propulsion. This clutch has a unique "slip" feature which enables the vessel to hover over sand beds while maintaining only steerage way.

On the lakes—on the rivers—and in busy ocean harbors, Cleveland Diesel power is the choice of operators who demand top efficiency and lowest costs.

A GOOD PRODUCT PLUS GOOD SERVICE GIVES TOP PERFORMANCE

CLEVELAND DIESEL

Engine Division of General Motors • Cleveland 11, Ohio

GM 1908 - 1958

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power on farm and industrial machines in Italy, and the larger size for small farm tractors.

LANZ, the famous Old German farm machinery manufacturer, acquired by Deere & Co. a few months back, has wheel diesel tractor models from 11 hp to 64 hp. Lanz has two models of its Alldog tool carriers in diesel models. On their self-propelled combine a 32 hp Mercedes Benz diesel is the power. On their larger pull combine a choice of Perkins or Mercedes-Benz is offered.

SASKATCHEWAN has a new law on its books called the Agricultural Machinery Act. It deals with both sale and testing of farm machinery in this leading grain growing province of Canada. A four- or six-man board is to administer the act and will test and appraise under actual working conditions implements sold or offered for sale in that province. The board will also undertake development work to improve and develop implements for use. With both U.S. and European diesels battling for the business in the west, those diesels that have been developed in the ruggd logging and dirt moving fields should have an advantage over the lighter tractors.

TWO GM 6-71 engines power the new LeRoi portable rotary compressor in what is claimed to be the highest rating available in a portable at 1,200 cfm at 100 psi. Two 2-stage air-cooled sliding vane type compressors can be operated independently or as a team.

DART Truck Co., now a subsidiary of Carlisle Corp. has a 55 year background of truck and tractor building. It has nine big diesel truck models, from 10 to 55 ton sizes, as well as its 18 ton underground conveyor dump shuttle truck for mining and its 25 ton crane carrier. All are diesel from 130 to 400 hp. Dart specialties seen on these trucks in mine, freighting and dirt moving are its box girder frame, front and rear suspensions, planetary axle, and rear tandem suspension. The Dart shuttle truck for underground work is powered by a DRX-501 136 hp Hercules with Cummins JN-6 optional and Allison torque transmission. Most of its trucks are powered by Cummins.

PRACTICALLY all the new small 14 to 28 hp tractors brought out this year in Europe, especially France, are air-cooled diesels. One leading French manufacturer announced he will build only diesel tractors from here on.

INTERNATIONAL Harvester reports eight of its big red TD24s are clearing land on the Bhakra site in India where it is planned to irrigate 10 million acres.

BY using its fleet of diesel crawler tractors, the United States Smelting and Refining Co. made dredge history in Alaska by moving a 680-ton dredge 7½ miles to a new location. Three HD 20 and 2 HD 19 Allis-Chalmers and 10 D8's and 3 D9's Caterpillars comprise the fleet of 18 diesel crawlers that did the job.

UNION Lumber Co., Fort Bragg, Calif., recently added three new Kenworth logging trucks to its fleet to make eight of this model 849 powered by Cummins NRTO-6-B—335 hp turbocharged engines. Main and auxiliary transmissions are Spicer. Rear axles Timken TSDD7; front axle Shuler 18A00; Hydrotarder, 15 in. single disk.

SWITZERLAND is building what will be the world's tallest dam in the Pennine Alps to add to its world leadership in hydro-electric power. International and other U.S. developed diesels are being used. The job is heavily handicapped by weather high in the Alps within sight of the Matterhorn. But with a schedule calling for completion in 1962, the diesels are keeping the project on schedule.

REPORT FROM A LEADING MIDWESTERN RAILROAD

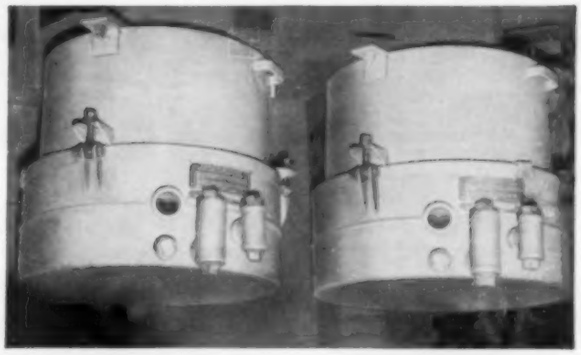
On 80 locomotives

...Air-Maze oil bath filters will

save thousands of dollars a year

by extending engine overhaul

Air-Maze Oil Bath Filter
removes 92% or more of all objectionable dirt from intake air. Photo shows installation on Alco 1500 horsepower freight unit.



The first Air-Maze oil bath filter installed on the air intake of a locomotive saved this railroad $4300.00 over a 27-month period. Since that time, 80 additional locomotives—switchers, road switchers, road freight and passenger locomotives—have been equipped with Air-Maze filters at the time of engine rebuilding.

Annual savings of $1900.00 realized by the first unit, have meant a return of over 300% on initial investment through reduced cost of power assembly changeouts and reduced cost of filter servicing. Because of reduced cylinder assembly wear and longer bearing life, plans are to extend engine overhaul periods 25% and more.

The only true, road-proved oil bath filter, Air-Maze provides effective air filtration at all engine speeds. It does not depend on air velocity to do an efficient filtering job. As a result, only clean, abrasive-free air enters the engine intake. The high dirt removing efficiency is unaffected by humidity or oil mist conditions.

Typical Air-Maze oil bath servicing consists of periodic filter oil changes in place usually at 3 or 6 month intervals and filter disassembly and complete cleaning at time of annual locomotive inspection.

Today over 3,000 Air-Maze oil bath filters are in use by over 75 domestic railroads . . . and many more now in foreign service.

For more information, write your locomotive builder or THE AIR-MAZE CORPORATION, Cleveland 28, Ohio. Dept. DP-9.

The biggest names in diesels are protected by Air-Maze filters

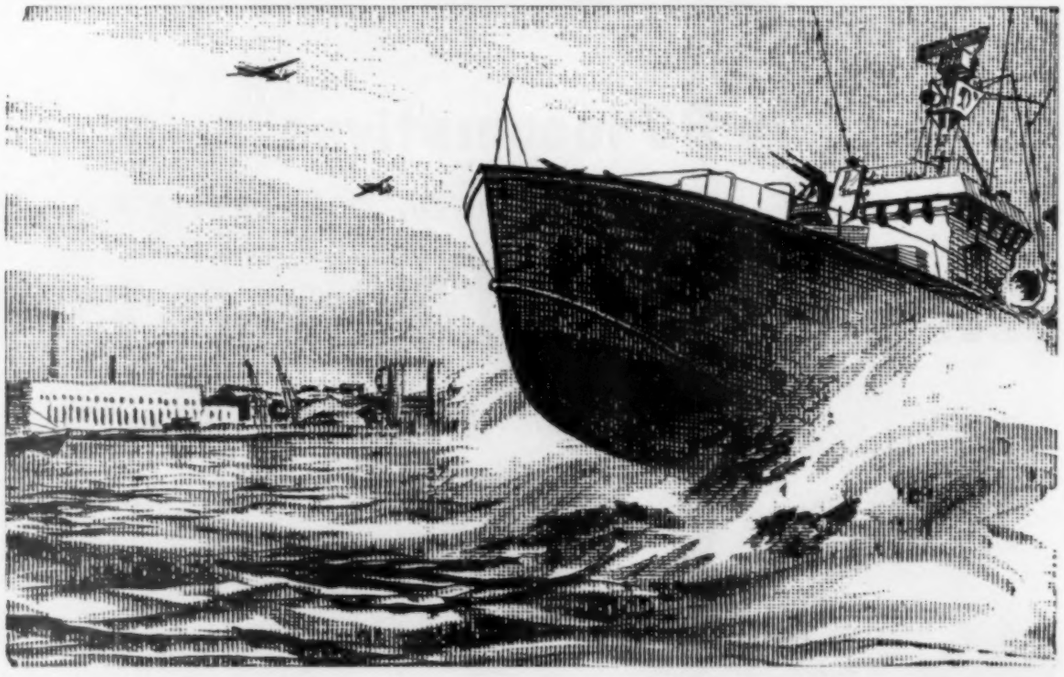
AIR-MAZE
The Filter Engineers

ENGINE AIR FILTERS • CAR BODY FILTERS • LUBE OIL FILTERS • PASSENGER CAR FILTERS

Mobile Power Unit Added

An Electro-Mobile power car, purchased recently by Saskatchewan Power Corp., is filling a long felt need in that province. The green and white unit was manufactured by General Motors Diesel Ltd., London, Ontario. Located on the Riverhurst-Moose Jaw line, the boxcar-size unit is being used during transmission line breakdowns, and is, in effect, a new transmission line into the heart of the area. The purchase of the unit is part of a plan to improve the electrical service on the line. A complete powerhouse-on-wheels, it is powered by a 1440 hp Diesel engine and produces 1000 kw of electricity, enough to carry a portion of the Riverhurst-Moose Jaw load should the need arise. A 6 mile line was constructed to connect the power distribution system with the new GM power car which is located on a railway spur. The power car is completely automatic which makes it completely self-operating at far outlying points. On receipt of a predetermined impulse, the controls can start the unit; synchronize and have the unit on the line in approximately sixty seconds.

MORE POWER AT LOWER COST—



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designed for strenuous duty and long service between overhauls.
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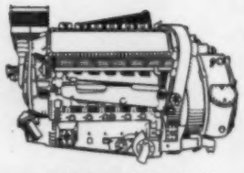
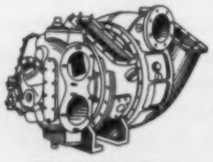


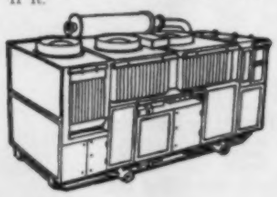
DELTIC 9 or 18 cylinder Diesel: engine for merchant ships. Powers fast patrol boats and mine-sweepers of many Navies, police and passenger launches and the world's most powerful diesel electric locomotive. Deltic Diesel Engines are designed for power outputs from 825 to 3,100 h.p.

ELAND 3000/4000 e.h.p. Turbo Prop:
heralds a new era of economy for the airline operator and cheaper fares for the air traveller.
The Eland powers the Canadair 540 Airliner, the Fairey Rotodyne and the Westland Westminster Helicopter.



TURBO BLOWERS:
available in seven sizes for diesel engines afloat and ashore. Napier blowers give maximum power increase with low fuel consumption. Now in service in 24 countries.

DELTIC COMPAK
A compact source of power, easily transportable to normally inaccessible places, comprising Deltic Diesel engine plus generator, radiators, fuel tanks, pumps, etc. Weight 35,000 pounds. Envelope 24 x 8 x 11 ft.



NAPIER ENGINES INC.
Suite 909, Dupont Circle Building, 1346 Connecticut Avenue N.W., Washington 6. D.C. Telephone: North 7-9300
A subsidiary of D. NAPIER & SON LIMITED · LONDON · ENGLAND
Partners in Progress with The ENGLISH ELECTRIC Company Ltd.
CRC 534

B&W Diesels for Brazilian Ships

In the course of July, two specially built refrigerator ships with B&W ALPHA diesel engines left Denmark, where they were built, bound for Brazil, for service on the Amazon. Vessels are of wood, built at the Frederikssund Shipyard, and of 60 GRT. They have 4 cylinder B&W ALPHA engines of the type 400-VO, developing 280/300 bhp at 375 rpm and are equipped with controllable pitch propeller.

Alco Realigns Marketing Program

Realignment of its field marketing organization has been announced by Alco Products, Inc. Under the new structure, sales managers have been established for the company's three major product divisions. According to W. F. Lewis, vice president-marketing, the move will provide the company with more specialized sales direction and selling effort in the field. "It is a natural outgrowth of the decentralization announced in October, 1956," Mr. Lewis added, "at which time Alco's transportation, spring and forge, thermal, and petroleum industry equipment divisions were formed." Assigned as sales manager for the thermal and petroleum industry equipment divisions is Paul W. Geisler; Robert W. Pittman is appointed sales manager for transportation products and services; and Robert H. Binkerd is named sales manager, industrial equipment, spring and forge division. All will report to A. T. Lawrance, general field sales manager for the company. The new organization becomes effective immediately.

Tuthill Pump Catalog Issued

A new 12 page catalog, No. 100, has just been published by the Tuthill Pump Company, Chicago. It contains basic information on the company's complete line of pumps, fluid motors and valves.

Internal gear pumps, sliding vane pumps and spur external gear pumps and fluid motors in the company's line are described in detail. Also covered are Tuthill relief valves provided in sizes from $\frac{3}{8}$" to $1\frac{1}{2}$", Powermite pump and motor combinations, and Powermax fluid motors. Included in catalog 100 are descriptions of the operating principles and internal constructions of Tuthill's various types of pumps, plus a complete pump guide selection chart that classify all models as to operating requirements, construction features, mountings, packing characteristics and the services for which applied. Copies of catalog 100 may be obtained by writing to Dept. PR, Tuthill Pump Company, 939 East 95th Street, Chicago 19, Ill. (ITS NEW)

West Coast News

By **James Joseph**

CENTRAL Station Equipment Co., Tucson, reports installation of four 500 hp, 312 kva diesel generating sets at a military base in southern Arizona. Details are being withheld pending military clearance.

FOUR Allis-Chalmers BD-77 diesels, 12 hp @ 1400 rpm, have gone to Pacific Pumping Co. to power pump units. Sale by Pacific Fishing and Trading Co., Seattle.

TO Dr. Mary G. Anderson, Seattle, to repower sport fishing boat, an Allis-Chalmers Model 6DAMR-273 diesel with Capitol 2:1 hydraulic marine gear. Sale by Portland's Hamilton Engine Sales, Inc.

SOLD to Woodland Electric Co., Woodland, Calif., a 65 hp, 48AG4½-4 Fairbanks-Morse diesel generating set.

FOR his new gravel plant at Ocean Lake, Ore., Lloyd Calkins has taken delivery of an Allis-Chalmers 6DAS-844 closed-type power unit set at 1550 rpm to a Rockford clutch, V-belt driven.

TO propel a 35' launch, the U.S. Coast Guard (Terminal Island, Calif. base) has purchased a GM 4-51 swinging 25x20 wheel thru 3:1 reduction. Sale by Crofton Diesel Engine Co. Inc., San Pedro, Calif.

DELIVERED: two 32 hp, model 45C4½, 2 cylinder Fairbanks-Morse basic diesels to Burke & Reynolds Construction Co., Wilmington, Calif.

FOR Frank S. Wade's boat *Diablo*, a GM 43200 RH marine diesel, installed at Artesia, Calif.

FOR W. W. Valentine's Los Angeles-based yacht *Kawamee*, a main and auxiliary engine—both GM (a GM 2061-A and a GM 6071-A).

TO San Rafael, Calif.'s Ralph E. Murphy & Sons, a Fairbanks-Morse 10½ hp, model 45B4⅛ diesel generating set.

AMERICAN Independent Oil Co., San Francisco, has taken delivery of a 10 cylinder, 800 hp, model 38F5¼ Fairbanks-Morse diesel engine.

FOR the motor vessel *Dailey*, an Allis-Chalmers 6 DAMR 844, 215 hp @ 2000 rpm marine diesel.

ALLIS-Chalmers DASMR 844 (supercharged, 275 hp @ 2000 rpm) marine diesel has been installed in the motor vessel *Tatoosh*. Sale reported by Pacific Fishing and Trading Co., Seattle.

INSTALLED in Bud Reitz's yacht *Margurita*, Long Beach, Calif., a GM 6071-A and 6072-A. Main propulsion unit swings 29x23 wheel thru 2:1 reduction.

TO Eugene, Oregon's Pete Bissett, a trailer mounted 5 kw air-cooled American Marc generator set for standby lighting on construction job at Clackamas, Ore.

TO Collins Electrical Co., Inc., Sacramento, Calif., a Fairbanks-Morse 36 hp, model 48A3½-4 diesel generating set.

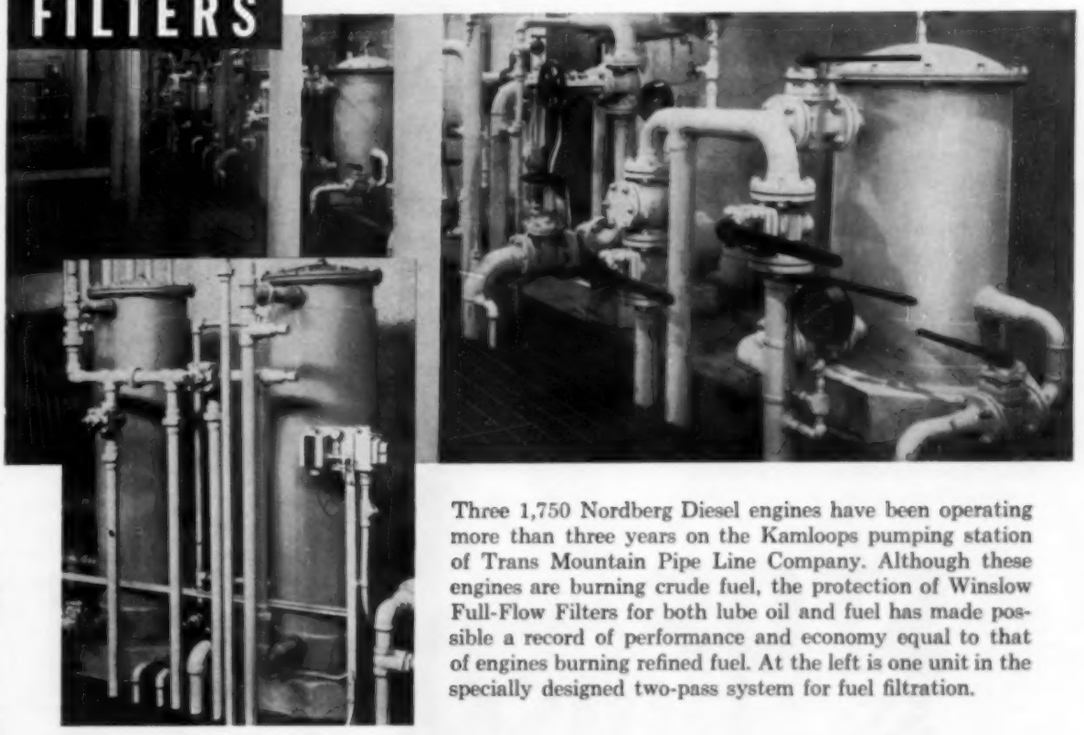
FOR Buena Park, Calif.'s Nutrilite Products Co.'s boat *Acania*, a GM 4061-A.

ALASKA Tug & Barge Co.'s *Alaska Queen* has been installed with a GM 2300S—sale by Crofton Diesel Engine Co. Inc., San Pedro.

FOR Roseburg Sand & Gravel Co., Roseburg, Ore., a 300 kw Allis-Chalmers generator set with 480 volt, 100 hp A-C electric motor for crushing operation near Swisshome, Ore.

WINSLOW
Full-Flow
FILTERS

Case History Report No. 34 Shows Why Engines Protected by WINSLOW FILTERS Last Longer



Three 1,750 Nordberg Diesel engines have been operating more than three years on the Kamloops pumping station of Trans Mountain Pipe Line Company. Although these engines are burning crude fuel, the protection of Winslow Full-Flow Filters for both lube oil and fuel has made possible a record of performance and economy equal to that of engines burning refined fuel. At the left is one unit in the specially designed two-pass system for fuel filtration.

20,000 HOURS OPERATION—Parts Replaced ONLY $300

CP* FILTRATION

Winslow patented CP* (Controlled Pressure) elements are designed to continuously self-adjust the pressure within the filter and allow for a full stream of filtered oil without opening by-pass valves. This is accomplished through the dual flow capacity, with two types of material.

After 20,000 hours operation in a three-year period, the first Nordberg Diesel in a Trans Mountain Pipe Line station was recently overhauled. In spite of the use of crude fuel, and difficult operating conditions, the engine was in such good condition that only $300 worth of replacement parts was required. This is another striking example of the long engine life and the substantial savings in overhaul time and replacement costs when dirt, acid, moisture and other impurities are removed by Winslow Filters. Standard or special installations of Winslow Full-Flow Filters can give you equal engine economies. Please write for complete information.

CP is fully protected by patents and trademarks*

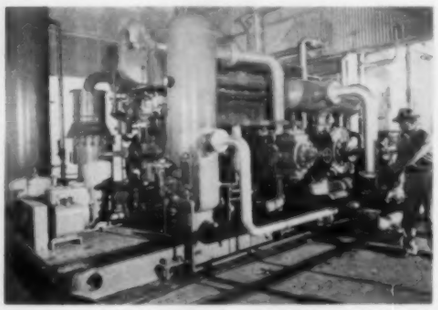
WINSLOW ENGINEERING & MANUFACTURING COMPANY
4069 Hollis Street, Oakland, California

Diesel Starter Fuel

Turner Quick-Start is a newly developed, compounded ether-base petroleum product, specifically made to trigger ignitions automatically. It also sustains initial combustion of regular fuel. Starter fuel is stored in a tank under pressure which discharges vapor through a copper tube into the manifold. To operate Quick-Start, just pull the choke out for about 2 seconds and touch the engine starting button. Turner Quick-Start fuel comes in a disposable tank that can be unscrewed from the unit and replaced in seconds. Each tank is good for about 250 starts. Installation is simple and takes but a minute or two on either vehicles or stationary engines. The fuel is particularly suited for trucks, busses, tractors, road building equipment, boats, mining equipment or any stationary installation where diesel power is used. Literature and prices are promptly available from Turner Brass Works, Sycamore, Ill. (ITS NEW)

Gathering Gas Compressor

Pictured above is a Worthington SLHC-4 cylinder turbocharged engine compressor newly installed at the Permian Basin Pipeline Company's compressor station near Jal, New Mexico, for gathering low pressure natural gas in the Permian Basin. This skid-mounted unit is one of two engines fabricated by the Foor Engineering Company. This engine is equipped with skids, engine and gas cooling equipment, gas scrubbers and safety controls by Foor Engineering before sale to the Permian Basin Pipeline Company. The 450 rpm Worthington unit is rated at 317 bhp @ 3700 ft.



Shovel Depends On Diesel

Offsetting the costs of removing overburden for coal production, the W. G. Duncan Coal Company is here cashing in on a sizeable vein of limestone running through its holdings near Greenville, Ky. Instead of piling up the limestone as waste with other overburden, the company hauls it to a crushing plant which turns out roadstone for building and maintaining roads within the mining area. Secondary to the company's coal mining activity, the operation has proven a profitable venture that is largely due to the impressive record of the Marion shovel shown above. The 1¼-yard Marion, powered by a 6-71 GM diesel engine, has worked steadily two 8-hour shifts per day for seven years with minimum expenses for upkeep. The hauling unit, one of three rear dump Euclid trucks on the job, is also GM Diesel-powered with a like service record.

STOP that NOISE

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NOISE —from the discharge to atmosphere of air, steam and other gases, with a Burgess-Manning Snubber. They are available with such plus features as: spark arresting; air cleaning; heat recovery; and surge control.

Send us an outline of your problem for recommendations and literature.

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Hartridge Nozzle Tester

Compact bench model for precision testing any type injector nozzle. Complete utility at low cost.

The perfect trio...

. . . for the Diesel repair shop. Provides the necessary equipment for running essential tests on injection units and for re-conditioning injector nozzles.

Write for details today on utilizing this perfect trio for outfitting the smaller service shop at moderate initial cost—or on adopting the units to speed service techniques in any repair shop.

Hartridge Nozzle Grinding & Lapping Machine

Insures perfectly concentric nozzle bodies and needles with a fine finish. Its immense scope, speed and ease of operation cut nozzle servicing costs.

Over 25 years of continuous research and production behind every Hartridge machine.

Fuel Pump Test Bench

For testing and calibrating all types of fuel pumps . . . provides utmost accuracy . . . rapid and easy to operate . . . combines rugged modern design.

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Factory Service School

Diesel engine specialists from four states attended the first accredited factory service school held in the western states, under the sponsorship of Diesel Control Corp., Wilmington, Cal., during last June 23 through 27. Representatives from sixteen fuel system service agencies, engine manufacturers, diesel fleet users, Army, Navy and Air Force were in attendance, coming from as far as Seattle, Wash. and Pheonix, Arizona. Purpose of the special training program was to acquaint West Coast maintenance and overhaul personnel with the factory recommended techniques developed by Hartford Machine Screw Company of Hartford, Conn., manufacturers of the Roosa-Master line of fuel injection systems. The Roosa-Master system is

used on high speed industrial, marine and automotive diesel engines. James N. Britton, Service Manager from Hartford, conducted the lectures and demonstrations. Sponsor of the training program, Diesel Control Corp., is the southern California Central Distributor for Roosa-Master, and their dealers from Bakersfield, San Bernardino, Los Angeles, San Diego and El Centro were among the group attending the program. Those from Seattle, Portland and Pheonix are Central Distributors for Roosa-Master in their areas. According to Stanley E. Franklin, of Diesel Control Corp., "our primary interest is in the better operation and field service of diesel engines equipped with Roosa-Master fuel systems, which necessitates the use of the latest overhaul and maintenance techniques. Training clinics of this type are among the ways to get fuller utilization of the capabilities of the engines. In addition to the very thorough instruction provided by Jim Britton, we were able to demonstrate the use of Unitest calibrating test stands, which we build, as applied to the Roosa-Master fuel system."

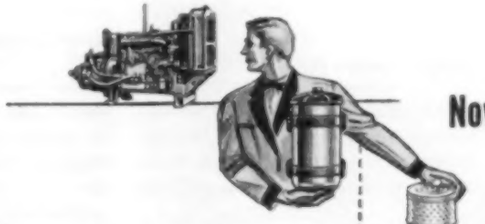
Marman Announces V-Band Tube Joint

Only two bolts are required for leak-proof, self-aligning tubing connections with the use of the new Marman Servicemaster V-Band Tube Joint. Especially designed for truck, bus and construction equipment exhaust systems and for stationary engine ducting, Servicemaster joints reduce servicing or part replacement down-time to a minimum. Easy to connect or disconnect, the Servicemaster is completely leakproof and provides superior resistance to vibration. Marman's V-Band principle—employed for years in the most critical, high pressure industrial and aircraft couplings—makes each joint positive without special aligning. As its two bolts are tightened, the Service-

Exploded view of Marman Servicemaster V-Band Tube Joint.

master's V-shaped internal surface exerts an inward radial force. This wedges the two flanged tubing ends together with an even contact around the entire circumference. No special gaskets, tools or skills are needed to make even the quickest repair a positive repair. Joints for 3½" and 4" O.D. tubing are available from dealer and jobber stocks in both mild and corrosion-resistant steel and other sizes from 1½" to 4½" can be supplied by the factory. (ITS NEW)

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG,** Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG,** 816 N. La Cienega Blvd., Los Angeles 46, Calif.



Now- a truly advanced, specially designed

Oil Filter and Cartridge for DIESELS

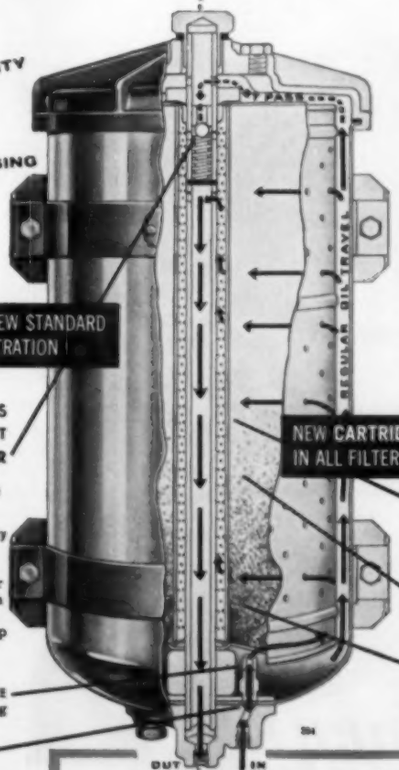
New DELUXE
HL-HS GRADUFLO
OIL FILTER AND CARTRIDGE

MAXIMUM ABSORPTION ABILITY

GREATER LOADING CAPACITY

FULL-DEPTH OIL CLEANSING

LONGER LIFE



Here's the latest advanced oil filter for heavy-duty diesel-powered operations! The new Graduflo design is based on fleet-proven DeLuxe engineering which has provided superior performance at lower cost to 1 out of 4 trucks on the road today.

The new Graduflo cartridge designed for this DeLuxe filter also fits and improves performance in other filters of this size.

Write today for performance data: Sales Manager, DeLuxe Products Corporation, Racine, Wisconsin.

DELUXE FILTER DESIGN SETS NEW STANDARD FOR DIESEL LUBE OIL FILTRATION

"ALL-WEATHER" RELIEF VALVE LETS OIL WARM UP QUICKLY...EFFICIENT FILTRATION STARTS SOONER

- √ Reduces Excessive Internal Pressure
- √ Prevents Cover Gasket Leakage
- √ Promotes Greater Cartridge Efficiency

This exclusive DeLuxe relief valve insures uniform pressure inside filter ... prevents cold unfilterable oil from entering the cartridge, directing it back to the crankcase for fast warm-up ... cartridge contaminants cannot be squeezed back into oil stream.

REMOVABLE METERING ORIFICE lets oil enter filter without agitating accumulated sludge

CHECK VALVE PREVENTS DRAIN BACK

CAPACITY:
Model HS (2.75 GALS) 500 cu. in.
Model HL (3.50 GALS) 750 cu. in.

NEW CARTRIDGE IMPROVES PERFORMANCE IN ALL FILTERS OF 500-750 CU. IN. CAPACITY

STAPLE COTTON FIBRES absorb 5.25 times their own weight in contaminants—including acids, moisture, suspended particles and colloidal impurities.

CARTRIDGE removes impurities and contaminants without affecting active additives in detergent oils.

HIGH MICRO-MECHANICAL ATTRACTION OF FIBRES gives maximum absorption ability and loading capacity. Insures longer and more economical cartridge life.

FIRST CHOICE... wherever used in CARGO or OFF-THE-ROAD DIESEL OPERATIONS

Named to Board

Election of two new members to the Board of Directors of Twin Disc Clutch Company, Racine, Wisconsin, has been announced by P. H. Batten, Chairman of the Board. The two new members are Mr. Ralph J. Kraut, President and Director, Giddings & Lewis Machine Tool Company, and Mr. Bruce F. Olson, president and Director, Sundstrand Machine Tool Company.

Koppers Adds Two New Couplings

The Metal Products Division of Koppers Company, Inc., Baltimore, has announced the availability of a newly-designed forged steel coupling, produced in sizes #5½ and #6, which are both stronger and lighter than cast steel couplings used in most of the same applications. In addition, the new forged steel couplings are offered at a lower cost than the cast steel, due to Koppers recent acquisition of the most modern automatic machinery available, the Company said. T. W. Chase, manager of Koppers coupling department announced that these two new sizes have been added to the Fast's forged steel line. Previously, this type had been available only in sizes #1½ to #5. The expanded line is in keeping with Koppers current policy of covering a wider range of applications. It is significant to note that the center flange of all Koppers standard forged steel couplings are now non-rabbetted and are also interchangeable with the cast steel type in the new sizes, the announcement said. Both halves of each coupling are now identical, and maintenance is simplified by the addition of two lubrication plugs. ITS NEW

High Pressure Filter

A new series of Laminated Fiber Disc Filters is now being offered by Wm. W. Nugent & Co., Inc. The new filters, designated as 1555CP, are designed for hydraulic and other high pressure applications. They are constructed for 3000 psi working pressure to comply with the requirements of the ASME Code for Unfired Pressure Vessels. API or ASME code inspection and stamping is available. 1555CP Filters are offered in five sizes with capacities ranging from 1.5 gpm at 3 psi pressure drop to 47.6 gpm at 6 psi pressure drop when filtering 100 SSU viscosity mineral oil. For larger capacities, the filters may be connected in multiple. Inlet, outlet and drain are located in the bottom of the filter. Complete information on 1555CP Filters may be secured by writing Wm. W. Nugent & Co., Inc., 3440 Cleveland St., Skokie, Ill. ITS NEW

New Torque Fluid Folder

A new illustrated folder providing complete information on D-A Torque Fluid has been published by D-A Lubricant Company, Inc., Indianapolis, manufacturer of heavy-duty lubricants for the construction industry. The attractive folder describes the use of D-A Torque Fluid in heavy-duty automatic transmissions, torque converters, rotary air compressors and hydraulic systems. D-A Torque Fluid is recommended for automatic transmissions and torque converters manufactured by Allison Division of General Motors, Clark, National Supply, Twin Disc Clutch Company and others. The new folder can be had on request by writing D-A Lubricant Company, Inc., Indianapolis 23, Indiana, or through local D-A Representatives. ITS NEW

E-M Makes Milwaukee Appointment

Electric Machinery Mfg. Company, Minneapolis, has announced the appointment of Robert C. Reiss as the company's sales representative in Milwaukee. Mr. Reiss, previously was attached to the E-M headquarters office as an outside salesman. Mr. Reiss joined E-M in 1954 after spending 5 years with an eastern electrical manufacturer. He is a 1949 graduate in Electrical Engineering from the University of Minnesota. His headquarters in Milwaukee will be at 700 South Fifth Street.

New In-Line Helical Gear Drives

Link-Belt Company now offers industry a quadruple reduction helical gear drive and new larger sizes of double and triple reduction drives to augment its present line of double and triple reduction in-line helical gear drives. Drives with capacities to more than 200 hp are available. The extremely compact quadruple reduction speed reducer, available in five sizes, extends the range of ratios as high as 2,217:1. The simple gear arrangement of these speed reducers consists of helical gear trains operating in high capacity ball and roller bearings mounted in a cast iron housing. Space requirements and layout problems are minimized by locating input and output shafts in the same horizontal and vertical planes. Automatic splash lubrication of all moving parts assures dependable lubrication and dependable operation at all speeds. Folder 2651A, a new 6-page supplement to Link-Belt Book 2651, provides complete data on horsepower ratings, dimensions, mounting information and contains a resume of construction principles applying to the new quadruple reduction gear drives. Similar information is furnished on two new sizes of double reduction and three new sizes of triple reduction helical gear drives. A copy of Folder 2651A may be obtained by writing: Link-Belt Company, Dept. PR, Prudential Plaza, Chicago 1, Ill.

Garrett Names Research Director

Appointment of Admiral Selden B. Spangler, U.S.N. (Ret.), as Director of Research for The Garrett Corporation, Los Angeles, a leading manufacturer of aircraft and missile components and accessories, was announced today by J. C. Garrett, president. Spangler, whose appointment is effective August 1, retired from the Navy recently after 39 years of service. Widely recognized as the father of the Navy's gas turbine program starting in 1939 and running through 1946, Admiral Spangler is usually given a large share of credit for overall development of the propeller gas turbine in the United States, and is directly credited with development of the turbo-compound engine. He will make his headquarters in Phoenix at Garrett's AiResearch Manufacturing Division of Arizona, the largest manufacturer of small gas turbine engines in the world.

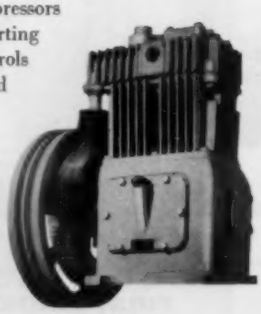
Admiral Spangler's background and unusual achievements, which have earned him the affectionate title among Naval aviators of "Mr. Powerplants of the Navy," are such that he is regarded by many as the nation's outstanding expert in this field. He was Director of the Power Plant Division of the Navy's Bureau of Aeronautics during World War II. Well known in aviation circles both as an engineer and pilot with 5,000 pilot hours to his credit, Admiral Spangler has made major contributions in most of the technical areas of aviation. He was graduated from the Naval Academy in 1923, is a Fellow of the Institute of Aeronautical Sciences and also a Fellow of the Royal Aeronautical Society of England. Prior to his retirement, Admiral Spangler had been Commander of the Naval Air Development Center, Johnsville, Pennsylvania.

DIESELS ON WATER?

. . . another assignment met by dependable

QUINCY COMPRESSORS

Naturals for marine duty, Quincy Compressors deliver the performance needed for starting and operating clutches, signals and controls as well. Models to 90 C.F.M. Authorized service stations from coast to coast.



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Quincy COMPRESSORS

QUINCY COMPRESSOR CO. • Dept. DP-958, QUINCY, ILL.

Elected To Board Of Directors

Caterpillar Tractor Co. has announced the election of Executive Vice President Charles A. Woodley to the board of directors of the Company. His election fills a board vacancy created by the death of A. L. Chickering on January 6, 1958. All incumbent directors were re-elected March 25 at the annual meeting of shareholders in San Francisco, and all officers of the Company were re-elected by the Board. Woodley joined Caterpillar in 1926 at the age of sixteen. After completing a machine shop apprenticeship, he advanced through various factory jobs to his first supervisory position in 1934. He was named general factory manager at Peoria in 1950 and was promoted to Peoria Plant Manager in 1953. He was elected a vice president in October, 1954, and elevated to executive vice president last October. He is a member of the Society of Automotive Engineers, past president of the Peoria Manufacturers Association and a director of the Central National Bank of Peoria.

Research Heads Named By Delco-Remy

As a major step in broadening its research and forward engineering outlook, the Delco-Remy Division of General Motors has announced the formation of an Applied Science Department and an Electro-Chemical Research Department. Applied Science will be under the supervision of Lewis R. Hetzler, and Electro-Chemical Research will be guided by Dr. John J. Lander. Both departments will report to Herman L. Hartzell, Delco-Remy Chief Engineer. The immediate objectives of the new departments will be to accumulate know-how in newly developed areas of science, and to keep Delco-Remy abreast of scientific trends and rapid changes in technology brought about by discoveries in such fields as electronics, electro-chemistry and solid-state physics. The eventual goal, of course, is to translate these advanced ideas into new and improved products for the division. Although Hetzler and Dr. Lander who head the new departments are comparative newcomers to Delco-Remy they both have a long record of specialized experience in their respective fields.

Organizational Changes At Stanley Engineering

Stanley Engineering Company announces that Sanford K. Fosholt, a partner in the Company, is assuming supervision of the Company's operating units; the Report, Design, Construction and Office Groups. Mr. Fosholt, a graduate of Iowa State College, in Electrical Engineering in 1938, has been with Stanley Engineering Company for 20 years. Bruce L. Sturdevant has been appointed head of the Design Group, succeeding Mr. Fosholt. Mr. Sturdevant graduated from the State University of Iowa in Mechanical Engineering in 1948 and has been with Stanley Engineering Company for 10 years. Willard R. Sheldon has recently been designated as head of the Building & Industrial Department in the Design Group. Mr. Sheldon graduated from Iowa State College in 1936 with a BS in Architectural Engineering. He has been with the firm since 1938 except for a period in the U.S. Navy during World War II. Murray W. Sedgley has recently become head of the Civil Department of the Design Group. Mr. Sedgley has been with the firm since 1948 and is a graduate of Iowa State College in Civil Engineering in 1931. Thomas D. Wenger has been appointed head of the Power Department of the Design Group. Mr. Wenger, a graduate of the State University of Iowa in Mechanical Engineering in 1948 has been with the firm since 1948.

Northwest Regional Manager

Allen C. Conger, formerly with the U. S. Bureau of Reclamation in Bismarck, N. D. and more recently one of the engineers in the New York office of Brown Boveri Corporation, has been appointed Northwest Regional Manager in charge of the corporation's new office opened March 15th in Portland, Oregon. Mr. Conger will be responsible for all operations in Oregon, Washington, Montana, Idaho and Alaska. He will concern himself with engineering and sales of all Brown Boveri power generating distribution, transmission and industrial equipment. Brown Boveri occupies Suite 701 in the Executive Building, 811 S.W. Sixth Avenue in Portland, Oregon, where Mr. Conger makes his headquarters.

New Transmission Booklet

A new 10-page, illustrated booklet on the complete line of single-stick, semi-automatic Fuller RoadRanger Transmissions has been published by Fuller Manufacturing Company. This brochure provides helpful data on the R-35, R-46, R-63, R-630-D, R-96 and R-960 RoadRangers for over-the-highway operation and the R-1150 and new R-1550 RoadRangers for off-highway service. Included are complete shifting patterns, gear ratios and the percent of step between ratios for all standard and optional ratios. Condensed specifications for weight, size, approximate engine size, mounting, clutch housings and oil capacity are shown for each model. The new RoadRanger booklet may be had by requesting Form No. 114 from Fuller Manufacturing Company, Kalamazoo, Michigan. (ITS NEW)

Rear Admiral Matthews Named to De Laval Post

Appointment of Rear Admiral Mitchell D. Matthews USN (Ret.) as Manager of the Service and Repair Division of De Laval Steam Turbine Company, Trenton, N.J., was announced by H. G. Bauer, De Laval executive vice president. Admiral Matthews retired from the U.S. Navy in 1957 after thirty years of service to join the De Laval organization. His last Naval post was that of Supervising Inspector of Naval Material, New York, which he had held since 1954.

A native of Maysville, Ky., Admiral Matthews graduated from the United States Naval Academy in 1927. After service on the *U.S.S. Arkansas* and the destroyers *Breckinridge* and *Tarbell*, he attended the U.S. Naval Postgraduate School at Annapolis for advanced studies in marine engineering. Admiral Matthews pre-war assignments included service as Office-in-Charge of construction of minesweepers, subchasers, and tank lighters, Office of the Supervisor of Shipbuilding, Bethlehem Shipbuilding Company, Quincy, Mass. His service during World War II included a distinguished command of the *U.S.S. Blakeley* and the *U.S.S. Butler*, and command of Destroyer and Mine Divisions. He served as Professor of Naval Science, University of Nebraska, from 1945 to 1948. From 1950 to 1953 he was Supervising Inspector of Naval Material in Chicago. Between these assignments Admiral Matthews was on active sea duty. He participated in the amphibious assault on Sicily in 1943, the Allied landings in France, 1944, convoy operations in the Atlantic, and in the Okinawa campaign, 1945. He holds several awards for his combat service, including the Silver Star Medal, Legion of Merit with combat device and Gold Star, Letter of Commendation with Bronze Star, and the French Croix de Guerre with Silver Star.

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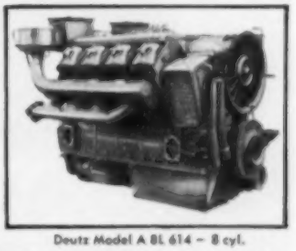

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Gas Turbines Purchased

The Garrett Corporation has announced the sale of 40 small gas turbine engines to Eastern Air Lines as a power source to start the Lockheed Electra propjets the carrier will place into service late this year. The little jets which will start the big jets are produced by Garrett's AiResearch Manufacturing division in Phoenix, Arizona. Mounted on panel trucks the turbines which weigh approximately 250 lbs and have an output of 200 hp, supply compressed air for pneumatic starting of the propjets as well as electrical power to operate the plane's refrigeration and heating systems and to check out the plane's radio, radar and hydraulic systems while on the ground. This is the first commercial application of the small turbines which have been modified from similar AiResearch units that are currently in use by the Navy and Air Force to start such aircraft as the F4D Skyray and the B-52 Stratofortress. Other airlines are also studying the possible use of having the little turbines, cart or truck mounted, to start the big turbine engines of all-jet as well as propjet aircraft say Garrett officials.

for the largest unit of its kind in the world...

Supercharger Intercooler and MONO-WELD® Engine Jacket Water Cooler by Young photographed prior to shipping to Venezuela.

Young Radiator Company provides the cooling system

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At home and overseas Young quality and experience have made the name "Young" synonymous with the best in design and construction. If you have a heating or cooling problem do not hesitate to consult us. There is no obligation.

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Line Type Hydraulic Filter

Newly designed line type filters announced by Marvel Engineering Co. for installation on suction or return line for filtration of hydraulic oils, fire-resistant fluids, coolants and lubricants.

Applicable to requirements of operating pressures up to 150 psi at temperatures up to 300° F., it is now being produced in capacity sizes of 10, 20, 30, 50 and 75 gpm with choice of Monel wire cloth mesh sizes from 30 to 100. All units are available with or without by-pass valve. For additional information write to Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill. (ITS NEW)

Field Sales Changes

Three transfers within the sales organization of American Air Filter Co., Inc., has been announced by C. A. Pickett, AAF sales manager. Charles Kannapell has been transferred to the Washington branch office from the Louisville branch office. Collins Hamblen has been moved to the New York City branch office from the Washington branch office. Charles Jacobs has been transferred to the New York City branch office from the Minneapolis branch office.

Self-Priming Pump

A new self-priming liquid ring pump for transfer and similar applications is described in Bulletin 725.6 issued by Goulds Pumps, Inc. of Seneca Falls, New York. This light weight pump handles air alone, liquid alone or any combination of air and liquid. It is designed for permanent installation or portable utility use. Specifications, performance curves and construction data are included. For a copy of Bulletin 725.6, write to Goulds Pumps, Inc., 41 Black Brook Road, Seneca Falls, New York.

(ITS NEW)

Branch Manager Named

The promotion of Ralph L. Reynolds to the position of Branch Manager, Grove City Sales Office, is announced by Grant C. Woodard, General Sales Manager of The Cooper-Bessemer Corporation. Mr. Reynolds fills the position formerly held by Fred W. Green, who has retired from the Company. In his capacity as Branch Manager, Mr. Reynolds will be responsible for the application and sale of compressors, diesel, gas and gas-diesel engines in Western Pennsylvania and Western New York, Mr. Woodard points out. Operating out of the Grove City, Pennsylvania, Sales Office, he will provide direct factory contact on all power and compressor requirements for gas pipeline, industrial, municipal and marine use.

Gas Engine Literature

A series of three new bulletins published by Ingersoll-Rand describes in detail a line of 4-cycle, V-angle gas engines designed for supplying power to industry. Three models of these gas engines are built. They are the PJVG, the smallest of the three, with a horsepower range of 220-295 hp; the medium-sized PSVG, with a range of 408-816 hp; and the large PKVG, which has a 880-1760 hp range. The machines are said to be rugged and compact and are built for dependable continuous service at partial or full loads and speeds. They are essentially the same engines which are built in Ingersoll-Rand's well-known JVG, SVG and KVG gas engine compressors. The manufacturer claims the engines' smooth-running 4-cycle operation makes them ideal for driving alternating current generators. They are also especially well-suited as prime movers for pumps, blowers, and other equipment. You may get your copies of the three fliers describing the gas engines, Form 10051 (PJVG), 10052 (PSVG), and 10053 (PKVG), by contacting your nearest Ingersoll-Rand branch office, or by writing Ingersoll-Rand Company, 11 Broadway, New York 4, New York.

Filter Development

Full-flow oil filtration has been added to the industrial and marine arrangements of two Caterpillar Series D diesel engines, according to a recent announcement by Caterpillar Tractor Co. The Caterpillar D375 (Series D) and D397 (Series D) industrial and marine Engines are now being supplied with three and four pleated, impregnated paper elements respectively, which will give complete filtration to the total volume of lubricating oil in the engines. This engine-mounted filtering system replaces the by-pass method formerly used. The Caterpillar full-flow lube oil filter system is designed to offer thorough protection to precision-machined, internal engine parts. The increased filter capacity of the system and the improved efficiency of the Caterpillar paper elements, permit extended oil filter change periods. For engines presently operating, oil filter changeover groups are available for field installation.

Interchangeable Quick Couplings

A new line of quick connect and disconnect couplings, which meet Military Specification MIL-C-4109A, is being introduced. This new line is interchangeable with other make couplings. These couplings are now available at the factory as well as distributors throughout the country, in various style end connections including male, female, hose stem and reusable hose end connections, in sizes ¼ in., ⅜ in., ½ in. and ¾ in., with working pressures up to 10,000 psi. The manufacturer's patented Pushomatic action, featuring one-hand operation, is incorporated in this new design. Coupling locks automatically, without turning or twisting. Locking mechanism makes a positive, leakproof connection, highly resistant to impact or rough handling according to the manufacturer. The interchangeability of these couplings makes possible replacement of either coupling sockets or plugs, without changing or having separate air lines to existing production equipment. This interchangeability allows the user to gain the advantages through replacement without necessitating a complete change over expenditure. Complete details are outlined in a new Bulletin #1500. Write Perfecting Service Company, Charlotte 6, North Carolina.

ITS NEW

Company Appointments

The promotion of James R. Craine to the position of Branch Manager, East Central District, is announced by Grant C. Woodard, General Sales Manager, The Cooper-Bessemer Corporation, Mount Vernon, Ohio. In his new position of Branch Manager, Mr. Craine is responsible for all application and sales of engines and compressors in the East Central area. His activities will originate from the East Central District Office, which is located at the home office of Cooper-Bessemer at Mount Vernon, Ohio.

The assignment of Donald T. Koch as Sales Engineer to The Cooper-Bessemer East Central District Office is also announced by Cooper-Bessemer Corporation. As Sales Engineer, Mr. Koch will work under the direction of James R. Craine, Branch Manager, and will contact gas transmission companies, oil and gas processing plants and users of industrial and municipal power. In this capacity Mr. Koch will work out of the East Central District Office, which is located in the home office at Mount Vernon, Ohio.

The assignment of William Brafford as field engineer to its Chicago District Office is also announced by Cooper-Bessemer Corporation. In his new capacity as field engineer, Mr. Brafford will work under the direction of Richard J. Wheelock, District Manager, contacting users of power and compressor equipment in the greater Chicago area.

Data Book On Flexible Tubing

A new technical data booklet has been made available to designers, plant engineers and purchasing agents by the Pennsylvania Flexible Metallic Tubing Company of Philadelphia, Pa. This 36 page booklet covers all types of flexible tubing and hose, together with the many types of couplings which can be used with the tubing. It points out the value of and steps in the proper application of tubing to all types of industrial installations, explains flexineering and how it can save money, time and labor. Flexineering is the proper application of tubing in conveying air, water, steam gases, volatiles, granular materials and all types of liquids. The booklet illustrates the tests tubing should be subjected to to assure peak performance and then illustrates many of the successful applications of flexible tubing. The majority of the installations illustrated are those where rigid piping has failed and the proper application of flexible tubing has resulted in more efficient operations and less maintenance. This booklet has been designed to place in the hands of key men throughout industry a ready-reference to flexible metallic tubing. A copy is available without charge to those key men writing on their company's letterhead to Department 104, Pennsylvania Flexible Metallic Tubing Company, 7200 Powers Lane, Philadelphia 42, Pa.

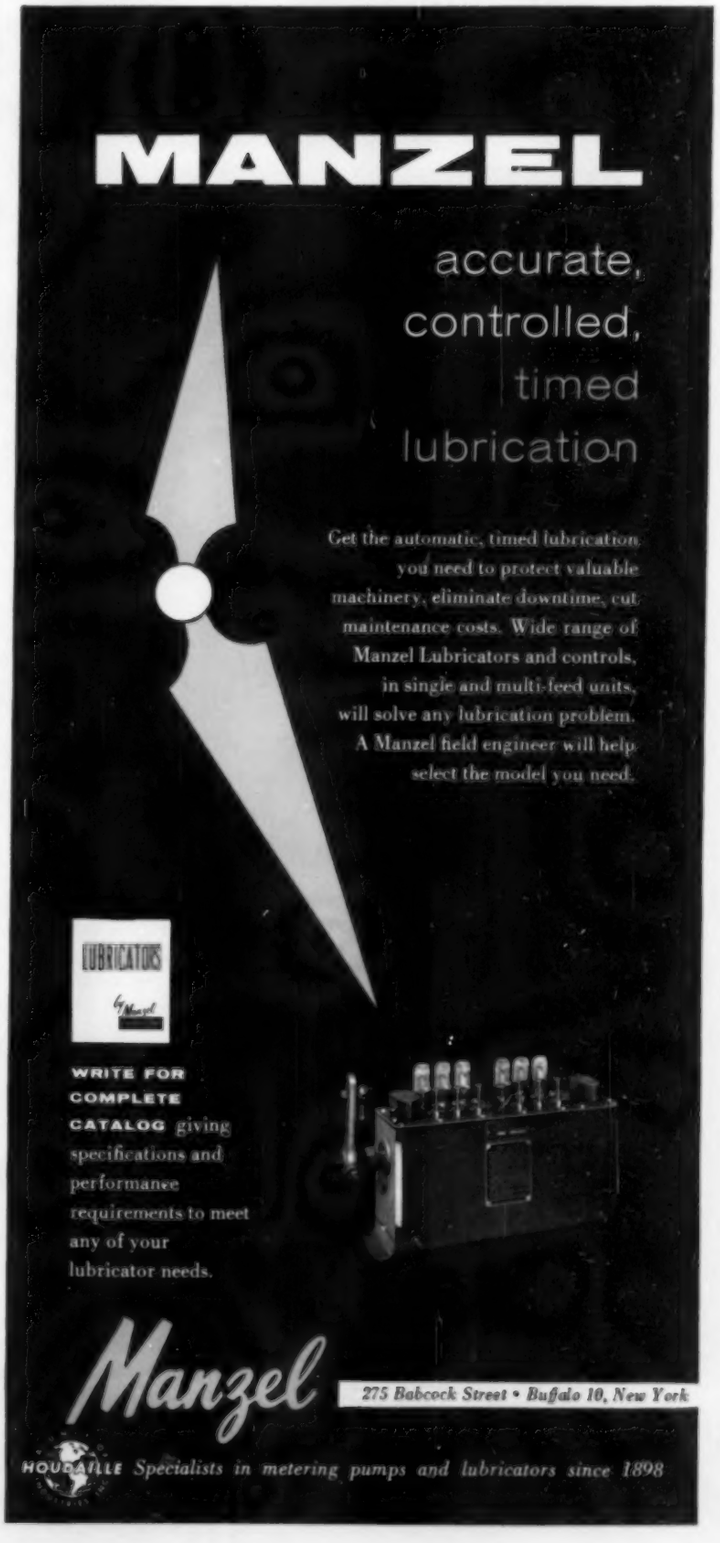
Systems Design Bulletin

Now available from the Systems Division of Epsco, Incorporated, is a series of technical bulletins describing the various custom engineered data handling and processing systems designed by the systems design engineers. Each individual bulletin describes a specific system—system design abstracts, illustrations, major specifications, discussion of operation and accompanying block diagrams. For a copy of this bulletin, write Epsco, Incorporated, 588 Commonwealth Avenue, Boston 15, Massachusetts.

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG,** Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG,** 816 N. La Cienega Blvd., Los Angeles 46, Calif.

Thirteen Kenworths Purchased

Denver Chicago Trucking Company, Inc., is adding 13 new Kenworth cab-over-engine Model 523 trucks, powered by NH-6-B Cummins diesels, to the large fleet of Kenworths already in use on this firm's widespread routes. The new tractors, now under production at the Seattle Kenworth factory, are all to be equipped with 73 in. tilt cabs with sleepers. Founded more than 20 years ago to offer better highway transportation between Denver and Chicago, the Denver Chicago Trucking Company is today a leader in the field. George J. Kolowich, Jr., is president of the trucking firm. This latest order from Denver Chicago Trucking Company was placed through Colorado Kenworth Corporation.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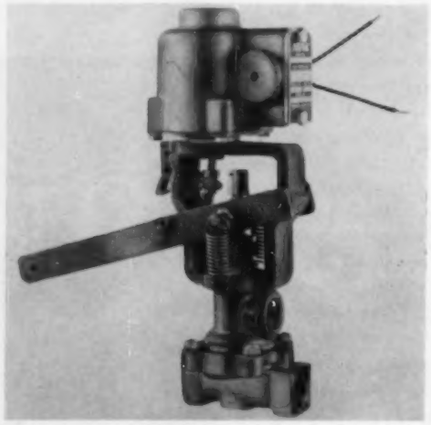
Manual Reset 3 Way Solenoid Valve

The Automatic Switch Company, of Florham Park, New Jersey, has developed a new manual reset 3 way solenoid valve. These 3 way valves are used wherever a valve is required that can be manually set and held in one position and returned to its original position electrically. Rugged, but



compact, the new Asco valve has a forged brass body and cast iron operating mechanism. A soft composition disc assures tight seating on all mediums. Two types of operation can be supplied —no voltage release or electrically tripped. It is available in ½ in., ¾ in. and 1 in. npt, all standard a-c or d-c voltages and general purpose, watertight or explosion-proof solenoid enclosures. For complete information write for Bulletin 8313, Automatic Switch Company, Florham Park, New Jersey.

Expansion Program Announced by East Texas Motor Freight

A $5,100,000 expansion and fleet modernization program is announced by Fred E. Tucker, Jr., Chairman of the Board, George E. Paschall, President and General Manager, and Marvin Blakeney, Jr., Vice President, of East Texas Motor Freight of Dallas. This expansion, which includes the start of construction on a huge, new Dallas terminal on a 15 acre tract at 4242 Irving Boulevard rounds out a five-year plan which has made ETMF one of the leaders in the industry. The company's fleet modernization program features a $3,700,000

equipment purchase consisting of 175 White "King-of-the-Highway" tractors powered by the Cummins NH-180 diesel engine, and 200 high cube Fruehauf, Strick and Trailmobile trailers.

Mr. Paschall said the Company's decision to turn to diesel power was made to assure shippers of greater dependability and uninterrupted scheduling. The diesels assure ETMF longer engine life, reduced operating costs, and allow for new "slipseat" operations which make it possible for 175 units to do the work which formerly required 279 gasoline tractors. Emphasis on speed and flexibility is underscored in the planning of the Dallas terminal, where a towveyor system speeds the assembly and distribution of freight between over-the-road equipment and pickup or delivery trucks; a pneumatic tube assures prompt communications between the docks and offices. ETMF's constantly controlled intra-city service is made possible by radio-dispatching units on its designated routes in Dallas. Inter-city control between terminals is made possible by teletype service.

Expansion and modernization outlays during the present phase of ETMF growth total $6½ million. During the last five years seven new terminals have been built and eight others were completely remodeled and enlarged. ETMF terminals are located at Little Rock, Arkansas; Chicago, Illinois; Shreveport, Louisiana; St. Louis, Missouri; Memphis, Tennessee; Beaumont, Dallas, Fort Worth, Henderson, Houston, Kilgore, Longview, Lufkin, Marshall, San Antonio, Texarkana and Tyler, Texas. As part of the program to improve service to shippers, ETMF has transferred drivers and has deployed maintenance people to assure proper care of equipment at each terminal. High maintenance standards are illustrated by the pre-departure check lanes through which equipment passes before each driver begins his duties.

Builds Logging Road

An International TD-24 crawler tractor demonstrates its versatility as it cuts a ditch on logging access road job near Naches, Wash. This machine and two other International crawlers are among the units owner D and W Bros. Logging Co., Naches, is using to pioneer and construct 11 mi of Class EE Forest Service road to give access to more than a billion ft of virgin timber on the south fork of the Treton River, near Naches. The firm uses another TD-24 and a TD-18, both equipped with dozers, as well as a Galion T-600 motor grader and a Link-Belt Speeder shovel, on this job.

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG,** Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG,** 816 N. La Cienega Blvd., Los Angeles 46, Calif.

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4. ACCESSORY EQUIPMENT—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.
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